JUL 16 1921
Medical Lib.

Vol. L. JULY, 1921 No 4.

ARCHIVES
OF
OPHTHALMOLOGY

FOUNDED IN 1869 BY HERMAN KNAPP

EDITED BY

ARNOLD KNAPP, NEW YORK
CARL HESS, MUNICH
WARD A. HOLDEN, NEW YORK

PHACŒRISIS . . . . . I. BARRAQUER

GLAUCOMA AND THE NASAL (SPHENOPALATINE (B.N.A.) MECKEL'S) GANGLION . . . . . M. H. POST, JR.

A MERCURY TONOMETER . . . . . MARTIN COHEN

THE SURGICAL TREATMENT OF EPITHELIOMA OF THE CORNEA . . . . . L. M. FRANCIS

THE CORNEAL SUTURE IN CATARACT EXTRACTION. E. C. ELLETT

CONGENITAL ATRESIA OF THE PUNCTA LACRIMALIA OF ONE SIDE . . . . . HARRY GRADLE

REPORT OF THE PROCEEDINGS OF THE SECTION ON OPHTHALMOLOGY OF THE NEW YORK ACADEMY OF MEDICINE . . . . . CONRAD BERENS, JR.

DISCUSSION ON "DIABETIS IN RELATION TO DISEASES OF THE EYE" AT THE ANNUAL MEETING OF THE OPHTHALMOLOGICAL SOCIETY OF THE UNITED KINGDOM, 1920 P. G. DOYNE

REPORT OF THE TRANSACTIONS OF THE OPHTHALMOGICAL SECTION OF THE ROYAL SOCIETY OF MEDICINE H. DICKINSON

(Complete contents inside)

G. P. PUTNAM'S SONS
2 WEST 45TH ST., NEW YORK

PUBLISHED BIMONTHLY SUBSCRIPTION, SIX DOLLARS A YEAR

Entered at the Post-Office, New Rochelle, N. Y., as Second-Class Mail Matter

NOTICE TO CONTRIBUTORS

The editors and publishers of the ARCHIVES beg to offer some suggestions to authors who propose to favor them with the publication of their contributions.

1. Authors will receive gratuitously twenty-five reprints of their articles. If a greater number is desired,—**notice of which should be given at the head of the manuscript, or at the latest on the first proof,**—only the additional cost of press-work and paper will be charged to the author. The **number so ordered should be inclusive of the gratuitous copies.**

2. In preparing manuscript for the compositor it is requested that the following rules be adhered to:

a. Write on one side of the paper. Type-written MS. is preferred.

b. Write without breaks, *i. e.*, do not begin each sentence on a new line. When you want to begin a new line or paragraph at a given word, place before it in your MS. the sign ¶.

c. Draw a line along the margin of such paragraphs as should be printed in smaller type—for instance, all that is clinical history in reports of cases, etc.

d. Words to be printed in *italics* should be underscored once, in SMALL CAPITALS twice, in LARGE CAPITALS three times; **antique** type should be so marked.

e. Let the title of your paper indicate its contents. If it is a general title, for instance, Clinical Contributions, mention the subject of each special communication,—for instance: CASE I. Sarcoma of Iris; CASE II. Exostosis of Frontal Sinus, etc. These special titles will appear in the table of contents of each number and each volume, under the heading of the general title, so that they will not be overlooked.

f. Illustrations should be carefully drawn on separate sheets.

3. Authors receive proofs for revision, which they should correct and return without delay. We beg, however, to remind our contributors that changes in the copy are equivalent to resetting, causing so much additional expense. We therefore request them to make, if possible, no alterations at all in their MSS., or, at least, to limit them to what is of essential importance.

When sending manuscripts for the ARCHIVES OF OPHTHALMOLOGY, please address the editor, Dr. ARNOLD KNAPP, 10 East 54th St., New York City.

ILLUSTRATING DR. I. BARRAQUER'S ARTICLE "PHACŒRISIS."

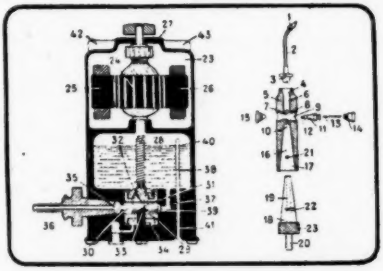

FIG. 1.

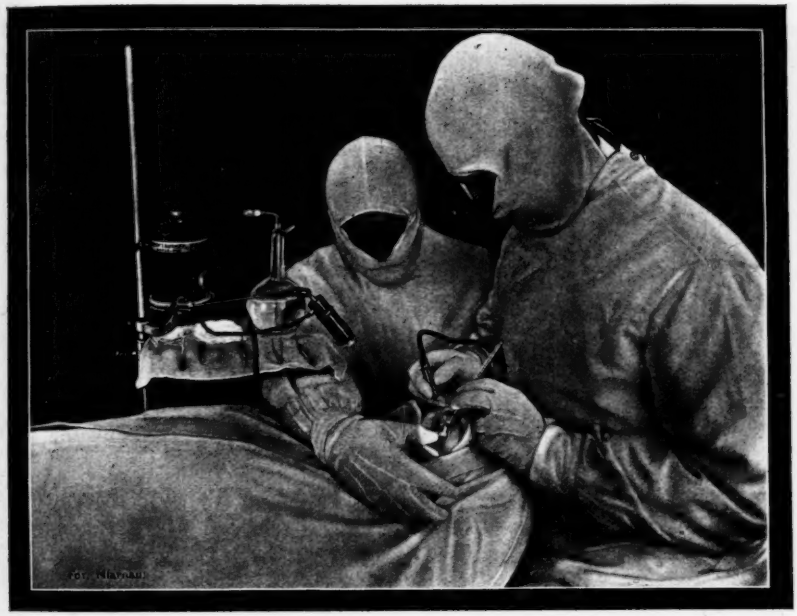

FIG. 2.

FIG. 3.

ILLUSTRATING DR. I. BARRAQUER'S ARTICLE "PHACŒRISIS."

FIG. 4.

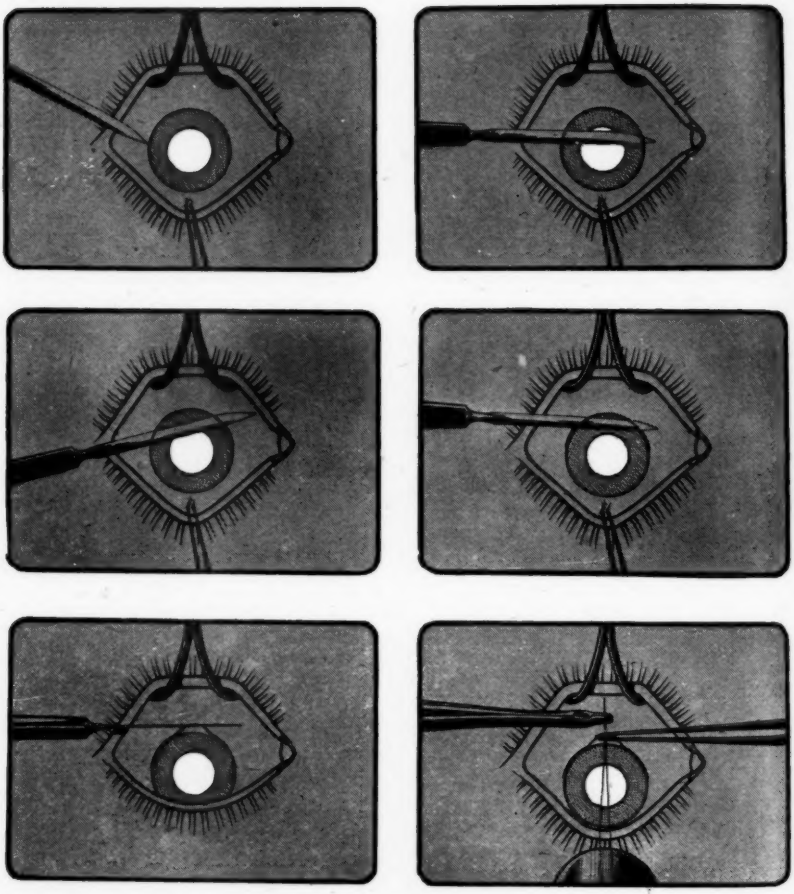

FIG. 6.

ILLUSTRATING DR. I. BARRAQUER'S ARTICLE "PHACŒRISIS."

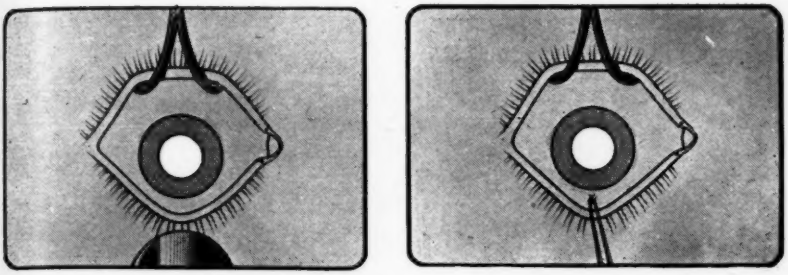

FIG. 5.

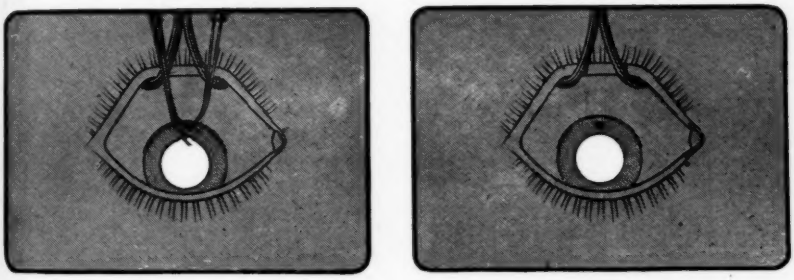

FIG. 7.

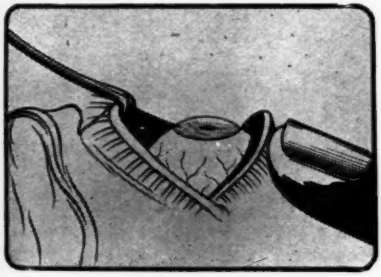

FIG. 8.

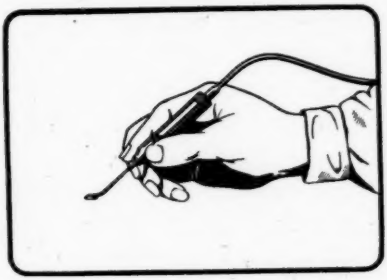

FIG. 9.

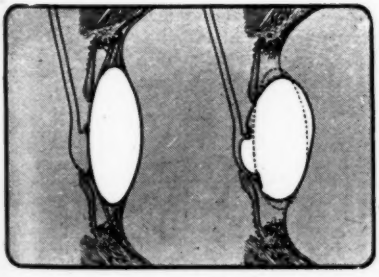

FIG. 10.

FIG. 13.

ILLUSTRATING DR. I. BARRAQUER'S ARTICLE "PHACŒRISIS."

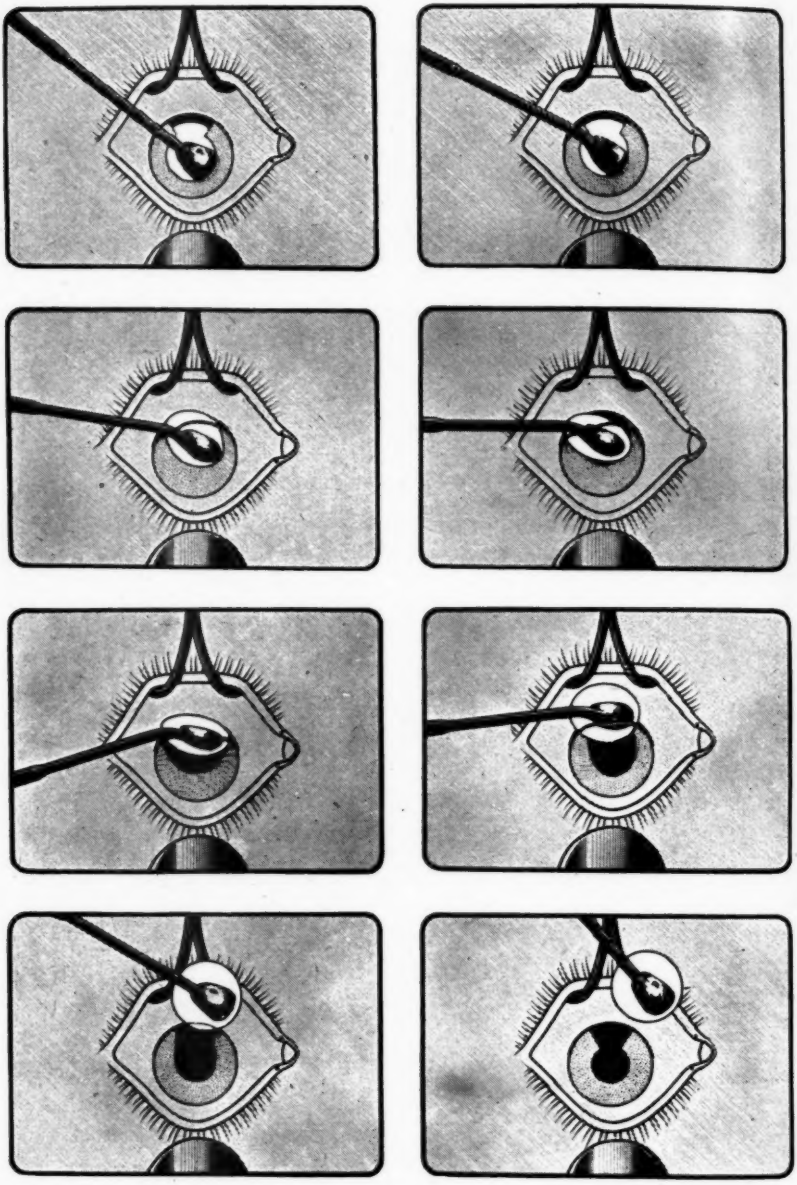

FIG. 11.

ILLUSTRATING DR. I. BARRAQUER'S ARTICLE "PHACŒRISIS."

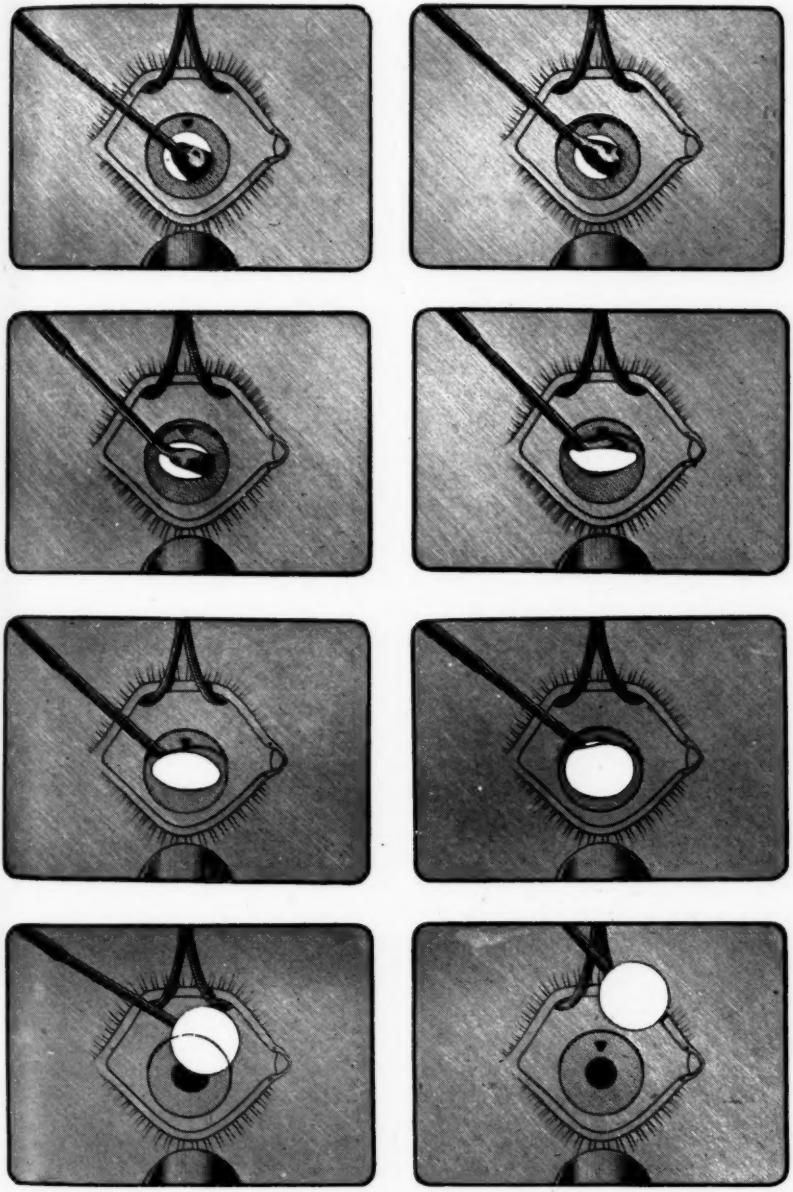

FIG. 12.

ARCHIVES OF OPHTHALMOLOGY.

PHACŒRISIS.

BY DR. I. BARRAQUER, BARCELONA, SPAIN.

(With thirteen illustrations on Text-Plates XVI.–XX.)

I. DANGERS OF CAPSULOTOMY AND ADVANTAGES OF COMPLETE EXTRACTION.

SINCE Daviel all ophthalmologists, knowing the complications of the cataract operation, have favored total extraction, but it has not become generally adopted because there was lacking an easy method which did not expose the eye to serious danger.

1. In studying the ætiology, development, and cure of the complications which occur at operation and in the after-treatment following extraction with capsulotomy, we see that:

(*a*) The repeated pressure which is exerted on the eyeball with instruments or through the eyelid with the finger to extract the retained cortex, injures the eye and favors the loss of vitreous. Prolonged toilet, irrigation of the anterior chamber, and other maneuvers which aim to remove the cataractous remnants predispose to iritis without completely succeeding in their object.

(*b*) Degenerated crystalline products which remain in the eye in varying degree obscure the pupil and dim the vision. These remnants, dissolved or emulsified in the aqueous humor, exert an inflammatory reaction and an endothelial proliferation which cause the secondary cataract to thicken, to form adhesions to the iris and other inflammatory lesions. The

aqueous humor is thus transformed into a good medium for the culture of microbes. Degenerated fragments of the lens, like the globules of Morgagni, vesicular cells, cholesterine, calcareous remnants, and sclerosed lenticular fibers, may remain between the lips of the corneal wound, retard its healing, and facilitate intraocular infection. Tags of the capsule may also become incarcerated in the wound, inviting the entrance into the interior of the eye of the germs which cause plastic iridocyclitis and other infections.

(*c*) A second operation to clear the pupillary opening of capsule (discission) or to remove the membrane which has followed iritis, and iridocyclitis due to the inflammatory reactions above described (irido-capsulotomy) expose the eye to serious complications without always restoring vision.

2. In total extraction:

(*a*) When we remove the lens completely in its capsule in a single step, we avoid introducing many instruments and many maneuvers into the interior of the eye, and if we do not press upon the eye we avoid the causes of complications.

(*b*) By not leaving even the smallest remnant of cataract nor of its capsule, as after the extraction of cataract in its capsule, we avoid all the unfortunate consequences produced by the inflammatory action of lens debris and their being caught in the corneal wound.

(*c*) All operations and their dangers are avoided because we do not leave any remnant of cataract nor of capsule and we have no inflammatory iritis. Normal vision is assured because nothing interferes with the transparency of the pupil and wound healing has taken a normal course.

II. DESCRIPTION OF THE APPARATUS.

Figure 1 shows a longitudinal section of the cup and of the vacuum pump. The cup consists of a suction cup 1 and a tube 2, terminating in a connection 3 which fits into a conical seat 4 of a distributing body 5. This body consists of a conduit 6, dividing into two small branches 7 and 8, which communicate with a chamber 9, on which are placed two conical valves 11 and 15, opposite to one another. Valve 15 closes the opening of channel 7, when seated, or gives access to air when open.

When valve 11 is closed passages 8 and 10 do not communicate. When slightly open it permits a communication across the chamber 9. Valve 11 is fitted with a pin 12, which is screwed into valve 15 and the valve 11 is acted upon by a compression spring 13 held in place by a cap 14. Passage 10 communicates with conical chamber 17, in which fits plug 18, which is center bored 19, and ends in a nipple 20, for attaching the tubing which transmits the vacuum from the pump described below. When the suction pump acts intermittently the vacuum is not produced in the cup because the operator holds the valve 15 slightly off its seat, and passages 7 and 2 communicate with the air, valve 11 is pressed down on its seat, prevents any communication between channels 8 and 10 and between channel 3 and the intermittent vacuum pump. If the operator wishes to create a vacuum in the cup, he closes valve 15. This automatically opens valve 11; this is due to action of the pin 12 connecting the two valves. Then the cup adheres from the action of atmospheric pressure and by the small oscillations due to its vibratory movement, produced by the intermittent vacuum pump. Whenever the operator wishes to suspend the action of this vacuum, it is only necessary for him to open valve 15, which at the same time closes valve 11. According to the physical conditions of various cataracts, it is desirable to be able to regulate the intensity of the vacuum produced in an intermittent manner, being careful that this vacuum is not absolute and it is sufficient to obtain a relative rarefaction of air in the interior of the cup. This is possible through the disposition of grooves situated in plug 18 and in its conical seat 17. In some of the models this regulating action has been placed in nipple 36. The pump is in two parts; in the upper 23 is an electric motor, of which the armature is shown in 24 and the field planes in 25 and 26, the collector in 27. A flexible shafting 28 leads to a cylinder 29, in which is fitted a solid movable piston 31, turned to fit the cylinder exactly. At the bottom of this cylinder there is a groove 32, in which is placed the shaft 33 attached to bottom of chamber 34 for the purpose of adjusting the position of cylinder 29. The shaft 33 is eccentric in its relations to the axis of 29. When cylinder 29 takes a rotary movement, piston 31 makes a to and fro movement in its seat 30 on account of its connection between the shaft 33

and the groove 32. A tube 35 leads from the chamber 34 to the opening 36, where there is a nipple to receive the rubber tube by which the suction is transmitted to the cup. The opening of tube 36 in chamber 34 is situated at the level of the opening 30, which contains piston 31. At the same level there is another channel 37, which opens into chamber 34 and into an upper chamber 38. At the point where channel 37 opens into chamber 34 circular grooving 39 has been cut in the cylindrical wall of chamber 34. Whenever piston 31 is drawn away from the opening of the interior mouth of tube 35, piston 31 is separated from the end of 29 and consequently it leaves a part of seat in bore 30 unoccupied and this motion of the piston sucks air from 35. This vacuum is transmitted through 35 and the connecting tube to the cup in which the air rarefies if communication 7 is shut off from the air. The air which by suction has penetrated into space 30 is expelled across groove 39 and tube 37 to chamber 38. This chamber up to a certain height and the entire inferior part of the apparatus contains lubricating oil to hermetically seal the lower chamber, the level reaching up to 40. The air which escapes from 37 to 38 passes through masses of oil and leaves externally by an opening 41 adapted for this purpose. The pump is driven by an electric motor, 24, 25, 26, and 27. The current is introduced at 42 and 43, producing in 39 by piston 31 a succession of repeated strokes in tube 35 and consequently in the cup, these periods being more frequent as the angular velocity in 29 is greater, this being governed by the heaviness of the oil. If this oil is thick it offers greater resistance to the motor and its speed is consequently lessened. It is indispensable to have a firm closure of the valves and the mechanical action must be very carefully looked after.

III. PREPARATION FOR THE OPERATION AND ITS TECHNIQUE.

This method of removal of the total lens is simple and is compatible with any method of performing the other steps of the operation. But in this article I am planning not only to show you how the apparatus works, but also to explain the many small details by which I have obtained so good results, most of which have been learned from the experience of my father.

1. Operating Room.—In the operating room the light must be diffuse and feeble. The operative field is to be illuminated obliquely by a projector, so that it is possible to see distinctly through the cornea into the anterior chamber, to recognize the smallest details in order to determine the methods of extraction which should be performed in the individual case. The operator alone is to speak to the patient; the assistants must remain silent. The instruments, carefully selected and sterilized, are placed always in the same order on a special stand near the field of operation, so that the operator, who is sitting on a stool at the head of the patient, may take up the instrument desired without removing his gaze from the eye of the patient. The surgeon and his assistants must follow the most rigorous antiseptic precautions and they should wear blouses, masks, and gloves of sterilized thread (Figure 2).

2. Preparation of the Patient.—Two hours before operation and after having washed the eyelids and the neighboring regions with soap, the ciliary border of the eyelids is painted with a 4% solution of nitrate of silver, neutralized by sodium chloride (Figure 3). The external disinfection is concluded by rubbing the eye with biniodide of mercury oil. The conjunctival sac is irrigated with an irrigating apparatus containing sterilized serum (Figure 4). Then for every ten minutes the operated eye receives the following drops which are prepared on the same day and are sterilized: cocaine hydrochlorate 0.25, euphthalmine hydrochlorate 0.25, adrenalin 3, sodium chloride (0.6%) 3. By this means anæsthesia and dilatation of the pupil are obtained after an hour and a half.

When the patient is placed on the operating table and surrounded with sterile towels which leave the two eyes exposed, we again irrigate the conjunctival sac, everting the upper eyelid with a rubber forceps so that the entire surface of the conjunctiva is irrigated. Some more drops of the above mixture are instilled and we teach the patient to move his eyes quietly down and up and to close the eyelids. Whenever there is a spasm of the fibers of the orbicularis or sudden twitching of the eyelids, it is desirable to produce a temporary paralysis of the orbicularis according to the method of van Lindt and Villard, with an injection of novocaine into the branches of the facial nerve.

3. FIXATION.—The assistant sitting to the right of the surgeon raises the upper eyelid by a Desmarres elevator, holding it in his right hand and at the same time drawing upwards the eyebrow with his little finger. The lower lid is held down with the other hand. The surgeon takes hold of the conjunctiva and the subconjunctival tissues *1mm* below the vertical meridian of the cornea with Landolt's forceps, without making any pressure upon the eyeball (Figure 5). The speculum so frequently employed does not bring the eyelids forward and the fixation at the nasal extremity of the horizontal diameter of the cornea facilitates pressure on the eye at the moment of puncture.

4. SECTION.—The flap must measure two fifths of the corneal circumference, with a small scleroconjunctival flap. The Graefe knife is held like a penholder with the right hand for the right eye and with the left hand for the left eye. The puncture is made in the direction of the radius of the cornea, *1mm* above the horizontal meridian. As soon as the thickness of the cornea is traversed, the blade of the knife proceeds parallel to the plane of the iris and in this meridian until it strikes the symmetrical point opposed to the point of puncture in order to make the counter puncture, after which in depressing the handle the inner third of the section is made. The third of the flap on the side of the puncture is cut in withdrawing the instrument, while the middle scleroconjunctival third is severed in directing the blade of the knife backward. During the corneal section the eye must not be displaced nor be permitted the slightest deformation. This is easily obtained if we use a perfect knife, making the puncture in a radiating direction, cutting slowly and uniformly, very gently, and being particularly careful not to exert any pressure with the forceps. A section which is too scleral cuts with difficulty in echelons and is predisposed to accidents during and after the operation. Indocile patients, insane, or those disposed to vomiting or to cough, and particularly in all of those in whom a loss of vitreous is feared or a turning back of the section, we make use of the conjunctival suture (Figure 6). Corneal suture before the completion of the section requires the exertion of slight pressure, which should always be avoided as it may cause a rupture of the zonule.

5. IRIDECTOMY.—A small iridectomy may be made if the cataract is swollen and large. It, however, predisposes to the zonular fibers being caught in the corneal wound. In order to avoid this, I prefer to make only a small peripheric opening in the iris, which always prevents iris prolapse (Figure 7).

6. EXTRACTION.—During this period the eye must be free without fixation. The assistant holds the lid gently drawn from the eye, supporting the hand on the cheek bone. The upper lid is drawn forward with the elevator of Desmarre, held in the operator's left hand (Figure 8). The patient looks slightly downwards. The erisiphaque is held with the right hand, as is shown in Figure 9. Without pressing on the valve 15 the cup is introduced into the anterior chamber on the side of the puncture for the right eye and near the counter puncture in the left eye, proceeding to the center of the pupil and still beyond, behind the iris, slipping along the anterior surface of the lens without producing the slightest pressure on the lens, at the same time perfectly adjusted to its surface. Then, without causing the slightest movement to the instrument, the hand being supported on the forehead of the patient, button 15 is pressed, whereby the vacuum enters into the cup and the lens is gripped. We recognize the completion of the vacuum by slight and repeated oscillations which cause a vibration of the lens itself. The zonular fibers are thereby put on the stretch, according as the dimensions of the lens are deformed in order to fill out the cup (Figure 10). The vacuum intensity to be employed varies between 55 and 65*cm* of mercury. An excessive degree of vacuum will rupture the capsule, while an insufficient degree allows the apparatus to slip from the cataract.

When the lens has been taken hold of by the cup and the zonular fibers are ruptured, we deliver the cataract by its upper border, if an iridectomy has been made, while its inferior border follows the curvature of the patellar fossæ, remaining always in contact with it without any pressure on the vitreous. The posterior surface of the lens must rub the scleral lip of the wound (Figure 11). If the patient looks down too far, or if the palpebral fissure is opened too widely, there is danger of loss of vitreous.

In simple extraction or in peripheric buttonhole iridectomy, we allow the lens to deliver by its inferior border, which is

easily done by turning the instrument so that the posterior surface of the lens presents towards the cornea. This is the method most to be recommended and in which one observes the fewest accidents (Figure 12).

During the steps of the extraction, which must be done slowly and gently, it is best for the patient not to look down too far and that the palpebral opening be not widely separated. The eyelids must be drawn forward and we must be careful that the lens does not during its movements cause any pressure on the vitreous.

7. TOILET.—In case that an iridectomy has been done, it is necessary to replace the columns of the coloboma and to replace into the chamber any fibers of the zonule which may have been caught in the wound. If extraction without iridectomy, all that is necessary is to place in the conjunctival sac some eserin salve 0.5% and to take due care that the conjunctival flap is in place.

8. BANDAGE.—The patient having gently closed his eyes, we apply bichloride salve 1 to 3000 to the eyelids, which kills the germs which are apt to grow out of the skin with the growth of the eyelashes. Gauze and cotton dressing is applied to each eye, held in place by adhesive straps applied to the temple, forehead, and cheeks (Figure 13).

IV. AFTER-CARE OF THE PATIENT.

We do not change the binocular dressing for three or four days, after which the eye which is not operated upon is left open. The operated eye remains bandaged for one week. During this time we do not do any dressings, because if the operation has been done according to the proper rules the patient does not have any complications or reactions. One sees a black pupil, round, central, reacting promptly to light and iridodonesis. It is striking to observe at the first dressing that the patient will present the usual appearance of operated eyes after two or three weeks. The percentage of operated-on eyes with visual acuity of 1 is much greater than that obtained by capsulotomy, and this normal vision is obtained from the first day to the particular astonishment of the assistants and to the great joy of the patient. This is in striking contrast to

the discouragement of not seeing sharply in the first weeks after an operation which so many patients on whom a capsulotomy operation is done have to suffer from.

V. CONCLUSIONS.

1. The accidents of the capsulotomy operation depend upon repeated pressure and maneuvers which we must make in order to remove as much as possible of the cataract; the persistence within the chambers of the eye of degenerated remnants of cortical material and of the capsule which is so readily caught within the wound, and the secondary operations undertaken to clear the pupillary region of the secondary cataract and to improve vision.

2. In phacoerisis we reduce the number of maneuvers within the eye to one; we use only one instrument and do not exert any pressure. In removing the entire capsular bag no remnant of cataract remains within the eye to produce inflammation and we obtain a perfectly transparent pupil. No other operations are necessary, because nothing interferes with vision.

3. The erisiphaque is a pneumatic forceps and a zonulotome, because the cup grasps the lens and causes a vibration whereby the fibers of the zonule are torn. This is an apparatus of precision, of delicate execution which must be perfect in its smallest details, adjustment, intensity, number of vibrations, etc.

4. The operation is simple and easy if the following rules are observed.

5. The operating room must not be too bright and the operative field must be illuminated obliquely with a photophore.

6. The pupil must be dilated at maximum. Anæsthesia and antisepsis must be perfect and the patient must be educated or the orbicularis should be temporarily paralyzed. The patient must never look strongly downwards.

7. The eyelids and the eyeball must be fixed without pressure. The eyelids must be drawn forward.

8. The flap should measure two fifths of the cornea; it must be cut gently without compressing or exerting any violence on the eyeball.

9. Iridectomy should be exceptional and peripheric button-

hole iridectomy is preferable, in which the iris is not drawn outside of the anterior chamber.

10. The lens is to be extracted slowly, with gentleness, without pressing on the crystalline lens when the cup is applied.

11. Toilet should be restricted to preventing anything being caught within the wound.

12. The bandage should be simply fastened to the skin of the surrounding region.

13. Put off the first dressing as long as possible. Normal visual acuity is obtained in a few days and in a percentage greater than that obtained after capsulotomy.

GLAUCOMA AND THE NASAL (SPHENOPALATINE (BNA.) MECKEL'S) GANGLION.[1]

By Dr. M. H. POST, Jr., St. Louis, Missouri.

THE ætiology of glaucoma is a subject that has occupied the minds of ophthalmologists from the beginnings of the science of ophthalmology. But the correct conclusion is still beyond our grasp. The final solution of this problem must ultimately be based upon the summation of many contributary observations, and realizing that fact, this paper has been written.

The summary of ideas to date has been very clearly stated by Dr. Wm. Campbell Posey in a recent paper read by him before the New York Academy of Medicine, January 19, 1920. (1) He there defines the two chief theories as being (1) the secretory theory, an increase in secretion as a consequence of some form of nervous irritation; or (2) the so-called retention theory, that it results from a mechanical obstruction, which is offered to the outflow of fluids from the eye.

Lagrange (2), who has been one of the chief exponents of the hypersecretion theory, believes it to be due to an excitation of the sympathetic nerve supply, and to an alteration in the blood vessels, and that secondary to this disturbance comes the obliteration of the excretory channels.

The nasal ganglion is the particular part of the sympathetic nervous system with which this paper is concerned. It is, however, advantageous to have a brief survey of the situation from a broader standpoint before taking up this more limited phase of the question. Casey Wood (3) has done this splendidly in his, "Excision of the Superior Cervical Ganglion."

[1] Read in abstract before the St. Louis Ophthalmic Conference, December 10, 1920.

There he gives the conclusion from the evidence collected by the symposium on the relation of the cervical sympathetic to the eye, held by the Section of Ophthalmology of the American Medical Association in New Orleans in 1903, and quotes as follows: "Electrical stimulation of the cervical sympathetic produces at first an increase and later a decrease of intraocular tension, the increase being probably due to an effect on the muscles of the eye. Slow acting, mechanically produced, irritation of the sympathetic causes a rise of tension, which according to Lodato is independent of dilatation or constriction of the blood vessels and also independent of the state of the pupil. Section of the sympathetic ganglion is followed by a fall of intraocular tension, which depends on vascular and perhaps muscular changes. The lowering of tension is perhaps more decided after excision of the ganglion than after section of the sympathetic cord, but in either case the effect is a temporary one, and may last more than a few days and sometimes disappears within a few hours."

The three principal conclusions reached were: (1) that stimulation produced increased tension; (2) excision was followed by a fall in intraocular pressure; (3) that this fall was only a temporary one; the changes being due to vascular and muscular alterations.

At the above mentioned symposium, de Schweinitz states that as early as 1727 Pourfour de Petit observed that, after section of the sympathetic the eye was softer. This operation was first proposed by Abadie (4) in 1897, who believed that increased tension was due to a vascular disturbance, an active dilatation of the blood vessels, particularly the arteries, the result of which was an increased exudation. Jonnesco (5), who first published accounts of the operation, thought it was caused by constriction of the capillaries followed by increased intravascular pressure, and that from this resulted increased transudation and probably an increase in the amount of aqueous humor.

Several hundred of these operations were done and were particularly satisfactory in the chronic simple type. Wilder's (6) series of 68 cases show improved, 26; temporarily improved, 10; stationary, 7; unimproved, 26. Rhomer's (7) series of 114 cases show improved, 79; negative, 29; worse, 6. Wilder concludes that "there is by this operation in a certain proportion

of cases of simple glaucoma, a definite and important result, and in some instances a decided improvement, even where a previous iridectomy has failed." Since that time, however, several patients have died as a result of the operation on which account it has been practically abandoned, although frequently of benefit.

In 1902 Rhomer (7) stated that excision of the ciliary ganglion produces a fall in tension and a pallor of the conjunctiva. He reported seven cases in which he claimed a partial reduction of tension following this operation. Its difficulty, however, made it practically prohibitive and it received little credence. No one attempted to follow him and Parsons believes that the results of Rhomer's work afford little support to the view that the increased intraocular tension of glaucoma is in any way associated with the ciliary ganglion.

Anatomically, we find that the sphenopalatine, also known as Meckel's, sphenomaxillary or nasal ganglion, is a small triangular reddish gray body with the apex backward, situated in the upper portion of the spheno maxillary fossa, although there is much variation as to the location. It is flat on its mesial surface, and convex on its lateral, and measures about 5*mm* in length. It receives the majority of its afferent fibers from the superior cervical sympathetic. It also receives fibers from the geniculate ganglion of the seventh through the great superficial petrosal. The second division of the fifth passes through it, but is apparently unrepresented among its neurones.

The efferent branches are usually divided into three groups, ascending, descending, and internal. The first of these are otherwise known as the orbital branches. Piersol (8) describes them as two or three tiny filaments passing into the orbit through the sphenomaxillary fissure and after traversing the posterior ethmoidal canal, or a small special aperture, are distributed to the sphenoidal and posterior ethmoidal air cells, and the periosteum of the orbit. Liedeman (9) describes an ascending branch to the lower angle of the ciliary ganglion. Hirzel and Arnold (9) traced filaments to the optic nerve or its sheath. Roth and Valentin (9) describes a branch ascending to the sixth nerve.

From these anatomical relations it would seem, that blocking of the nerve impulses at the nasal ganglion should produce

results similar to extirpation of the superior cervical sympathetic, and by a far less dangerous and difficult technique, as evidenced by the fact that Dr. Greenfield Sluder has injected, with alcohol, about 2000 ganglia for various conditions with no bad results.[1] It might have the further advantage of being more permanent than operations on the cervical sympathetic as being more liable to block any collateral nerve supply, such as appears to become established in some cases shortly after the removal of the latter.

In 1887, Emil Berger, as noted by himself (10) stated, that a direct influence upon intraocular tension, visual fields, etc., was exerted by morphine and cocaine applied to irritated tissues in the nose, and that the tension in persons predisposed to glaucoma, was lowered thereby. He attributes this action to the trigeminous as being the result of vaso-constriction of the vessels of the iris. The latter findings do not seem to coincide with our observations, a point which we return to later.

Various methods of nerve blocking have been tried in collaboration with Dr. Sluder, who has very enthusiastically carried on the nasal work, and some very interesting facts have been established.

Dr. Sluder was first led to a belief that cocainization of this ganglion might give relief in glaucoma, from his experience in cases of obscure headaches. In 1908 Dr. A. E. Ewing sent him a patient who had had an iridectomy for glaucoma three days previously and was again having an attack of increased tension. Unfortunately eserine ½% was used and given to the patient at the first examination before nasal treatment was instituted. A 50% solution of cocaine was applied to the region of the nasal ganglion which membrane was much reddened and swollen. Within a few minutes the pain in the eye and temple had ceased entirely. The next morning the patient was much improved. This latter fact, I believe in view of our present information, was due to the use in the meantime of the eserine solution, as the effects of cocainization could hardly have lasted for such a period of time.

Dr. W. H. Luedde (11) reported three cases in October, 1912. The first of these consulted Dr. H. Edward Miller, with a

[1] Abducens paralysis in one case.

tension O.D. 60*mm*, O.S. 51*mm*. No miotic was used. There was severe suppurative pansinusitis right and left. He used cocaine freely to shrink the swollen membrane. Three quarters of an hour later without further ocular treatment, tension O.D. 55*mm*, O.S. 37*mm*, a marked decrease on the left side. During the next three days under eserine, the tension fell to 26*mm*, at which time the patient left the city. The second case showed the middle meatus almost closed with swelling. Anæsthetization of the ganglion was followed by a rise of tension from 70*mm* to 73*mm*. On the following day, before nasal treatment the tension was 44*mm*, having been reduced by the use of eserine. After anæsthetization of the ganglion the tension remained the same. We believe the failure in this case can be attributed to the acute congestion of the nasal mucous membrane, preventing the absorption of the cocaine solution and its proper application directly contiguous to the ganglion. In the third case, no mention is made of the nasal condition. The tension before anæsthetization was, O.D. 17*mm*, O.S. 15*mm*. After treatment O.D. 18*mm*, O.S. 17*mm*. This case illustrates the fact, which has been observed several times, that the tension of the normal eye is not altered by anæsthetization of the ganglion. That the ganglion was reached by the anæsthetic was demonstrated by the finding that pain which could not be controlled by atropine locally, was immediately relieved.

In June, 1913, Dr. H. Edward Miller (12) published an account of the nasal treatment of the first case reported by Dr. Luedde with additional notes of further work at subsequent date. He there states, that owing to the marked inflammation of the nasal tissues, it was impossible to anæsthetize the ganglion by applications of cocaine. This lead him to attempt injecting the ganglion with six minums of 5% alcoholic solution of phenol. Tension quickly rose, but the following day, dropped 20*mm*. Five successful attempts in all were made with an average rise of 10*mm* immediately after the injection, followed by an average drop of 17½*mm*.

These cases both from a practical and a theoretical standpoint left much to be desired. Practically, the constancy of the reaction, its amount, and its duration must be known, and made as great as possible. Theoretically, we must determine whether this is a specific reaction to cocaine or a definite nerve

blocking similar to that affected by symphathectomy, and if possible how the effect produced causes a reduction of tension.

With these points in view, we have tried several drugs and combinations. Cocaine saturated solution alone, and cocaine and adrenalin 1-1000 half and half have been tried, and finally in an effort to prolong the period of lowered tension, alcoholic injections, 95% in phenol 5%, were used.

Eight cases have been used for the investigation to date, and nineteen observations have been made. A tabulation of these cases is herewith presented.

An analysis of the appended chart shows that, in four cases where the region of the nasal ganglion was cocainized, a fall of 9, 12, and 21*mm* was noted, within the next hour. The following day the tension had risen to slightly above the preliminary reading. The fellow eye was examined in only one case, and there the fall was 3*mm*. In cases number one and two, the middle meatus was cocainized with no measurable change in the tension.

In three cases, cocaine and adrenalin were used to anæsthetize the nasal ganglion. The two first of these cases were of the acute congestive type and no appreciable change occurred in the tension in either eye. The third case, of the chronic simple type, showed a fall of 9*mm* in the corresponding eye, but none on the opposite side.

We had hoped by combining adrenalin with cocaine solution to increase the extent of the reaction, but so far, possibly from a poor selection of cases have been disappointed in our expectations. The reason for this belief lies in the results obtained by Dr. W. E. Shahan and Dr. L. T. Post (13) in their study of the results obtained in lowering the tension by subconjunctival injections of cocaine and adrenalin. They found that epinephrine 1-4000 alone usually caused a rise in tension, cocaine 5% alone, produced some fall, but when combined with epinephrine 1-4000 it produced, in most cases, a more decided fall in tension, which lasted about an hour.

Analysis of four cases in which alcohol was injected into the nasal ganglion, shows in the first case a distinct rise in tension of about 7*mm* in the corresponding eye with no change in the fellow eye. In the second case, an initial rise of about 3*mm* followed by a fall of 20*mm*, which did not again regain the previous height for three weeks, after which time it again

slowly fell, the fellow eye showed a fall of 5*mm*. The third case was scarcely conclusive as the patient was hard to control and used the miotic rather casually, previous to the time of the alcoholic injection. There was, however, a marked fall of 36*mm* without the initial rise being noted, probably, however, because the tension could not be taken at this time. The fourth case had had an iridectomy six months previously, but tension had again risen. For several days the patient had been using eserine $\frac{1}{120}$ every two hours, tension remaining at 51*mm*. With a view to reducing the tension preliminary to operation, the nasal ganglion was injected with alcohol at 12:30 P.M. At 3:15 P.M. the tension had risen to 55*mm*. Twenty-four hours after the injection it had fallen to 37*mm*, where it remained approximately until the operation, four days later. In case number five, an effort was made to inject the ganglion, but the unruliness of the patient resulted in a failure.

In conclusion, while I realize that the number of cases studied is insufficient to make any dogmatic statements, it seems to me definitely established that the intraocular tension can be affected by blocking the nerve impulses at the nasal ganglion, and that this is not a specific action of cocaine but a true blocking. The duration of the reduction of tension with cocaine and adrenalin is about one hour, and its amount is about 10*mm*. Whether this is increased by the addition of adrenalin, is still in doubt. Injections of alcohol produce a greater drop, about 15*mm*, which lasts for ten days, and perhaps longer, an observation in line with what would be expected from the anatomical findings; for it was noted by Otto May (14) that the gasserian ganglion examined two weeks after alcoholic injections, showed almost no cell destruction, the process having largely subsided at the end of that time.

In all of my observations it was found, that the applications of cocaine must be directly contiguous to the ganglion and the alcoholic injections must be directly into the ganglion, or no result is obtained. This fact coupled with the anatomist's observation, that the fibers of the trigeminus pass uninterrupted through the nasal ganglion, and the well-known experience of surgeons that extirpation of the cervical sympathetic reduces the tension in glaucoma, leads me to believe that the reaction is not due to the trigeminus, but rather to the sympathetic.

In none of these cases was a blanching of the conjunctiva or retinal vessels noted. It was also observed, that the size of the pupils remained constant, but this might readily have been due to the miotics, which were used in almost all these examinations.

Looked at from a practical therapeutic standpoint, the case of Dr. Luedde and Dr. Miller was certainly benefited, and it is my opinion, that in certain cases where pilocarpine and eserine are being used to the limit, they may be reinforced by cocaine or alcoholic injections in such a way as to carry the patient past the acute condition. I am of the opinion, that cocainization of the nasal ganglion immediately before, or better, injection of alcohol about four days previous to operation in order to still further lower the tension and perhaps help in producing anæsthesia, which is especially difficult in these cases, will prove to be of value, bearing in mind that it is used, not as a substitute, but as an adjunct to all other possible therapeutic measures.

In closing I want to express my appreciation of the painstaking work, and inspirational enthusiasm of Dr. Greenfield Sluder, who has made these observations possible, and also to Dr. Wm. H. Luedde for his many helpful suggestions.

BIBLIOGRAPHY.

1. Posey, William Campbell. Archives of Ophthalmology, vol. xlix., No. 3, p. 293.
2. Lagrange. *Archives d'Ophtalmologie.* February, 1908, p. 65.
3. Wood, Casey. *A System of Ophthalmic Operations*, vol. ii., p. 1130.
4. Abadie. *Archives d'Ophtalmologie*, vol. xix.
5. Jonnesco. *Centralblatt für Chirurgie*, 1899.
6. Wilder. *Transactions of the A. M. A.*, Section of Ophthalmology, 1913.
7. Rhomer. *Annalles d'oculistique*, July, 1902. Part 1.
8. Piersol. *Human Anatomy*, p. 1240.
9. Liedeman. *Quain's Anatomy*, vol. vi.
10. Berger, Emil. *Encyclopedia Française d'Ophtalmologie*, vol. iv., 1903.
11. Luedde. *American Journal of Ophthalmology*, October, 1912.
12. Miller, H. Edward. *Annals of Otology, Rhinology, and Laryngology*, June, 1913.
13. Shahan and Post. *Transactions of the A. M. A.*, Section of Ophthalmology, 1920, p. 99.
14. *British Medical Journal*, August 31, 1912, p. 465.

No.	Name.	Age.	Date of Treat.	O.D. or O.S.	Duration of Glaucoma.	Type.	Nasal Treatment.	Location of Application.	Tension Previous to Nasal Tr.	Tension Following Nasal Treatment. 1 Hr.	Tension Following Nasal Treatment. Subsequent	Other Medication.
1.	Mrs. F. E. D.	55	11/28/19	O.D	8 yrs.	Chronic Simple	Cocaine	Rt. Spheno Maxillary Foramen	40mm	28mm	24 hrs. 43mm	Pilocarpine 1/10 q3h Eserine 1/10 P.M.
	" " " "	"	"	"	"	Chronic Simple	Cocaine	Rt. Middle Meatus	39½mm	40mm		" "
	" " " "	"	"	O.S.	10 mo.	Chronic Simple	Cocaine	Rt. Middle Meatus	31½mm	29mm		" "
*	" " " "	"	1/5/20	O.D.	8 yrs.	Chronic Simple	Alcohol Injection	Rt. Nasal Ganglion	33mm	37mm	24 hrs. 41mm 48 hrs. 44mm 10 days 39mm	" "
	" " " "	"	"	O.S.	10 mo.	Chronic Simple	Alcohol Injection	Rt. Nasal Ganglion	34mm	34mm	24 hrs 38mm 48 hrs. 41mm 10 days 27mm	" "
2.	Miss M. M.	61	12/5/19	O.D.	6.5 yrs.	Chronic Simple	Cocaine	Rt. Nasal Ganglion	52mm	43mm	24 hrs. 60 mm	Pilocarpine 1/10 T. i. d.
	" " "	"	12/5/19	O.S.	6.5 yrs.	Chronic Simple	Cocaine	Rt. Nasal Ganglion	25mm	22mm	24 hrs. 26 mm	" "
	" " "	"	12/11/19	O.D.	6.5 yrs.	Chronic Simple	Cocaine	Rt. Middle Meatus	55mm	52½mm		" "
	" " "	"	12/11/19	O.S.	6.5 yrs.	Chronic Simple	Cocaine	Rt. Middle Meatus	26mm	28mm		" "
	" " "	"	12/15/19	O.D.	6.5 yrs.	Chronic Simple	Alcohol Injection	Rt. Nasal Ganglion	52½mm	54mm	24 hrs. 37mm 48 hrs. 44mm 4 days 34½mm	" "
	" " "	"	12/15/19	O.S.	6.5 yrs.	Chronic Simple	Alcohol Injection	Rt. Nasal Ganglion	28mm	26mm	24 hrs. 26mm 48 hrs. 26mm 4 days 22mm	" "
3.	Mrs. A. E. McC.	76	2/11/20	O.D.	4 yrs.	Chronic Simple	Alcohol Injection	Rt. Nasal Ganglion	56mm		3 days 27mm	" "
4.	Miss M. S.	63	10/15/20	O.D.	2 yrs.	Acute Congest.	Cocaine and Adrenaline	Lt. Nasal Ganglion	53mm	59½mm		" "
	" " "	"	10/20/20	O.D.	2 yrs.	Acute Congest.	Alcohol Injection	Rt. Nasal Ganglion	55mm	51mm		" "
5.	Mrs. M. V. B.	57	12/30/19	O.S.	6 mo.	Acute Congest.	Cocaine	Lt. Nasal Ganglion	104mm	83mm		No other tr.
6.	Mr. R. J.	70	10/12/20	O.D.	Unknown	Acute Congest.	Cocaine and Adrenaline	Rt. Nasal Ganglion	69mm	72mm		" " "
7.	Mrs. R. D. K.	50	10/23/20	O.D.	Normal	None	Cocaine	Lt. Nasal Ganglion	19mm	19mm		Pilocarpine 1/10 T. i. d.
	" " " "	"	10/23/20	O.S.	7 yrs.	Chronic Simple	Cocaine and Adrenaline	Lt. Nasal Ganglion	47½mm	38½mm		" "
8.	Mrs. E. T. J.	70	12/7/20	O.S.	2 yrs.?	Acute Congest.	Alcohol Injection	Lt. Nasal Ganglion	51mm		3 hrs. 55mm 24 hrs. 37mm 48hrs. 38mm	Pilocarpine 1/10 T. i. d. Eserine 1/10 P.M. Iridectomy 4th day

A MERCURY TONOMETER.

By Dr. MARTIN COHEN, New York.

(*With six illustrations on Text-Plates XXI. and XXII.*)

PROFESSOR SCHIÖTZ was the first to measure intraocular pressure by means of a mercury manometer applied externally. This instrument was finally replaced by the present Schiötz tonometer, which is not only more readily applicable but possesses the principles of manometer and tonometer combined.

The Schiötz tonometer corresponds in its readings, as we have found, with the mercury manometer, but it is difficult at times to obtain a definite reading with precision on the former, owing to its sensitiveness, which causes its indicator to oscillate excessively. Julius Many, a mechanical engineer, to whom I gave a few suggestions, devised this mercury tonometer, and I have tested it both clinically and experimentally.

The mercury tonometer is based upon a simple physical law, and gives a direct reading in terms of *mm* of mercury of corneal resistance, which varies with intraocular pressure. Its readings are accurate and precise; it avoids the vibrations of an indicator by making use of a column of mercury in a glass tube, and no graphs or changing of weights are necessary. The instrument utilizes a single weight of mercury, on the principle of a mercury manometer. The mechanical adjustment of its various important parts, the plunger and the corneal foot plate, is controlled by the physical condition of the cornea and the intraocular pressure itself. It has been thoroughly tested on numerous human eyes with normal and increased pressure, and modified from time to time, until in its present form, its reading may be considered manometric in its accuracy.

ILLUSTRATING DR. MARTIN COHEN'S ARTICLE "A MERCURY TONOMETER."

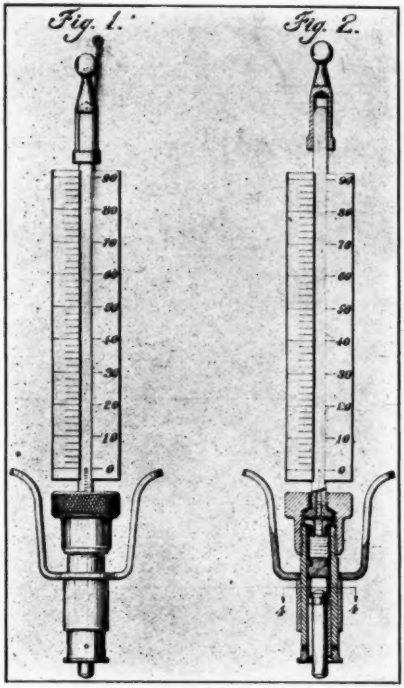

FIG. 1.

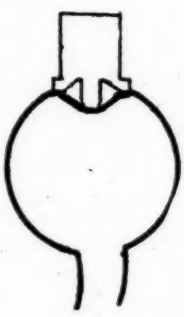

Fig. 2.

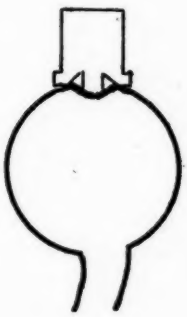

Fig. 3

Fig. 4

ILLUSTRATING DR. MARTIN COHEN'S ARTICLE "A MERCURY TONOMETER."

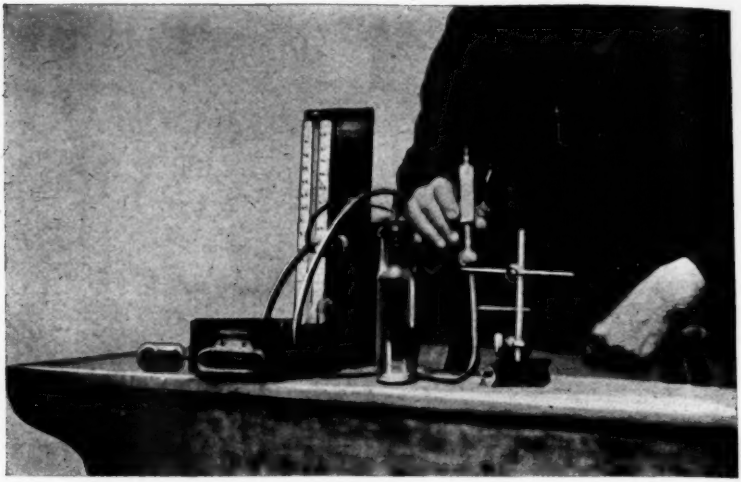

FIG. 5.

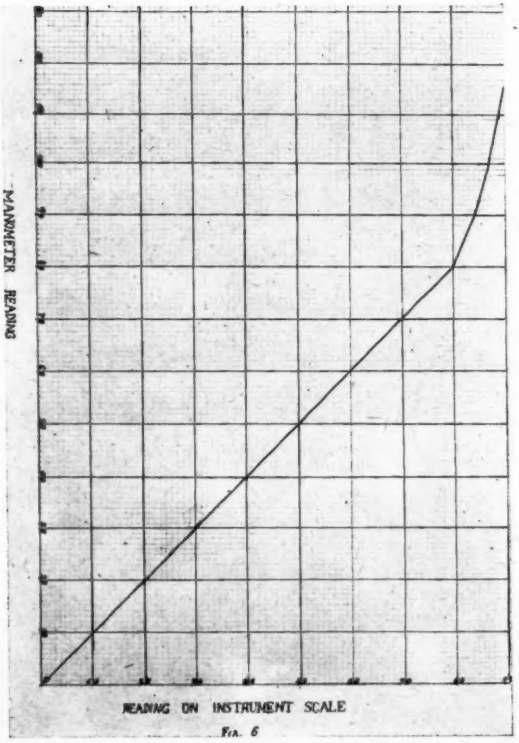

FIG. 6

The graduation of the scale was established according to the ratio of the area of the piston to the area of the bore of the capillary glass tube. Thus, the graduation is magnified ninety-four times, and a reading of 90*mm* of mercury on the tonometer signifies that the plunger has made an excursion of slightly less than 1*mm*. We accepted 20*mm* of mercury as the average normal intraocular pressure, according to Schiötz, and after indicating this normal finding at a fixed point on our scale, we examined over one hundred human eyes with normal pressure, and found that this average reading, as accepted, corresponded with the Schiötz tonometor. If any other point were selected as the normal, the accuracy of our readings would not be altered. Our calibration is equally divided, into division of 2*mm* of mercury and represents a straight graph from zero to a reading of 90*mm* of mercury, relatively corresponding to the mercury manometer. The calibration of the instrument is dependent upon several physical factors acting in unison, as will be explained.

The pressure of the mercury, combined with the weight of the piston and the plunger, produces dimpling of the cornea, which is dependent not only on the intraocular pressure but also upon the resistance of the cornea, as evidenced in tests conducted upon living or enucleated, normal or diseased eyes. If the corneal resistance is below normal, the intraocular pressure will be diminished, and vice versa. The same holds true with the intraocular pressure. As the corneal resistance is probably similar in all eyes, any slight differences must be considered as negligible in the estimation of intraocular pressure.

The adjustment of the instrument has been determined by testing it on human eyes, and experimentally with the aid of the mercury manometer on fresh and old enucleated human eyes, pigs' eyes, and rubber membranes. By these experiments we decided on the form, size, and weight of the instrument and its various parts, and established a straight graph.

Some of the important parts of the instrument will now be considered. The lower end of the plunger is made convex, since thereby it is easier to dimple the cornea and at the same time avoid injuring it. The extent of its convexity and length was determined after numerous tests on the living human

cornea, giving an accurate reading from the highest to the lowest point on the scale, corresponding relatively with the reading of the manometer. The corneal foot plate was made flat at its periphery; and at a fixed point it takes the direction of a definite angle, as shown by the illustration.

When the instrument is applied to the eye, if the tension is low, normal, or about as high as 40*mm* of mercury, the foot plate will come in contact with the cornea only at its flat part, but at different points depending on the tension, as shown by Figure 2. But if the intraocular pressure is heightened, the foot plate will come in contact with the cornea at the interior of its angle, again at different points, depending upon the increased pressure. For example, if the tension is around 60*mm*, the contact will occur at the lowest extremity of the angle, as shown in Figure 3; if still higher pressure exists, the contact will occur near the highest extremity of the angle, as shown in Figure 4.

The fact that the thickness and curvature of the cornea vary slightly from its periphery to its center, was responsible for the unequal division of the scale in our earlier experiments. We were therefore obliged to establish a definite angle in the foot plate to overcome this condition, and also to permit the registration of the higher regions, thereby producing an equally divided scale and a straight graph.

The instrument is applied perpendicularly to the eye, after the instillation of holocaine, and is placed exactly on the center of the cornea, leaving a small rim of cornea exposed to assist in orientation. This position of the instrument permits the plunger to come into contact with the apex of the cornea, which is the most favorable point for measuring pressure. If the plunger is off center, we shall have a slightly higher reading, as the cornea is thicker at that point. The difference in tension is probably due to the difference in the corneal resistance of the areas examined.

After the application of the instrument to the eye, the plunger should be removed by slightly turning its exposed part; it, as well as the cylinder, should then be cleansed. This procedure will prevent the accumulation of foreign material, or the collection of tears.

From our experiments we have proved that capillary attrac-

tion need not be considered in making readings. Two applications of the instrument to the eye are sufficient, as frequent applications lower the intraocular pressure.

Figure 1 represents an elevation, showing the parts sectioned. The instrument consists of a metal tube; extending from its lower extremity is a foot plate. At the upper part of its interior is a reservoir of mercury, which is attached at its lower edge to a piston resting around the shoulder. The upper edge of the reservoir is hermetically connected to a capillary glass tube by means of prepared thread and a leather washer.

The glass tube carries a scale graduated in equal divisions, reading from zero to 90*mm* of mercury; at its upper extremity a lock is fitted in order that when in use it may be slightly raised to allow air to enter the tube; when not in use, it is pushed down to prevent any loss of mercury. A regulator is attached to the back of the scale, so that the zero point may be adjusted to a level with the mercury column. This regulator is rarely used, as extreme heat or cold will cause the height of the column to vary less than 2*mm*.

Surrounding the metal tube, is a handle which slides easily and avoids friction, and should simply steady the instrument in its proper position.

The weight of the instrument is 44 grams. It is so constructed that the pressure produced in the mercury reservoir by the rise of the mercury in the capillary glass tube, plus the weight of the plunger and piston, is accurately counterbalanced by the weight of the remaining portion of the instrument.

The reservoir is made of chemically treated fish skin, in order to maintain durability, softness, and consistency. Its thickness is only $\frac{1}{20}$*mm* throughout. The lower edge of the bag is attached to the piston; its upper edge, to a washer of the same diameter as the piston. The outer diameter of the bag fits exactly into the bore of the metal tube. We have used such a bag daily for over a year, without any change in its durability, softness, or consistency.

The glass tube is accurately gauged, and the bore is absolutely of the same diameter throughout. The graphs were made, as shown in the illustration, by using human enucleated eyes and applying the mercury manometer as indicated (Fig.

5), checking the readings from the zero point upward on the manometer, and comparing them with the tonometer at definite points.

We were able to secure a straight graph (Fig. 6) from zero to 80*mm* of mercury. From 80 on, however, it required great pressure to preserve the straight line, the variation being due to the flattening by the plunger of the corneal apex, which loses its resiliency in the dead eye. This flattening would not occur in the living eye.

Over 150 normal cases have been examined with the mercury tonometer, all giving the normal reading around the 20*mm* mark, agreeing with the Schiötz tonometer. In one case of simple glaucoma, the Schiötz tonometer gave a reading of 60*mm* of mercury. The mercury tonometer gave the same reading. The following day, after medication and massage, both instruments registered 50*mm* of mercury.

In conclusion, I desire to express my obligations to earlier workers in the same field. The instrument would have been impossible but for the invaluable researches of Schiötz, Priestley Smith, and McLean.

THE SURGICAL TREATMENT OF EPITHELIOMA OF THE CORNEA.[1]

By Dr. L. M. FRANCIS, Buffalo, N. Y.

(With five illustrations in the text.)

THE corneoscleral junction should offer a favorable site for the development of epithelioma for at this point there is a variation, in the kind of epithelium. As Fuchs has pointed out, this situation is the analogue of the predilection of epithelioma for similar transition areas in other parts of the body. This locality is also exposed to traumatism and various forms of irritation, which are supposedly contributing factors in the excitation of tumorous growths. Therefore, it is difficult to say why neoplasms are not encountered more frequently at the limbus. While the condition is not extremely rare, as a search of the literature reveals, yet no single observer has seen many cases. I may therefore be pardoned for presenting my experience with the few that I have encountered.

During seventeen years of rather active hospital and private practice, I have recognized four and probably five cases.

Case 1.—Has no direct bearing upon the phase of the subject I wish to present and may be mentioned here. J. H. D., No. 2552, male, age 50, a clerk by occupation, was seen November 15, 1910. Family history and general health, excellent. Wassermann and tuberculin tests negative. Fifteen years ago a spot appeared at the limbus in the upper nasal quadrant. The eye had not been painful at any time, but was frequently irritated. The patient complained chiefly of lacrimation and blurred vision. Examination showed an elevated mass occupying all of the cornea save

[1] Read before Section on Ophthalmology, New York Academy of Medicine, April 21st, 1921.

a small clear quadrant downward and outward. The neoplasm had two large nodules on the cornea, the invaded limbus was infiltrated and adjacent bulbar conjunctiva much thickened and vascularized. This conjunctival envolvement gradually lessened as the fornix was approached. The fornix and palpebral conjunctiva appeared normal. (*See Drawing.*) An enucleation (not exenteration of the orbit) was done. The specimen was sent to Dr. E. V. L. Brown of Chicago who reported it as epithelioma of benign type with no involvement of the intraocular structures. Enough of a conjunctival sac remained to permit the wearing of a satisfactory prothesis. Despite the extensive involvement of the bulbar conjunctiva, I was surprised that there was no recurrence. This fact was of some value in approaching later cases.

CASE 5.—Likewise has no direct bearing on the subject as presented and will therefore be mentioned here. R. W. M., age 57, No. 1322, presented a small process at the limbus, recognized within the first six months and treated with radium with complete disappearance. The diagnosis was a clinical one and unfortunately the patient died from an intercurrent disease within the year after radiation. This case was presumably referred to by Dr. H. H. Janeway in a paper before this Academy, November 19, 1919, and published in Knapp's *Archives*, March, 1920. The remaining three cases will be presented later in this paper.

According to Panas, epithelioma of the limbus commonly starts from the outer side. This occurred in but one of my cases, the other four being located on the nasal side. One naturally looks for the process in the late segments of life. Four of my cases ranged from 50 to 76. Case number one, aged 50 when seen, dated his trouble back to 35, while another of my cases, Case 3, was 31 when seen, whose trouble appeared three years previously, namely at 28. (de Schweinitz and Shumway reported a case in a patient of 34 in 1913 before the American Ophthalmological Society.) It is interesting to note that in that article Rogman is quoted as reporting cases in patients age 20 months, 12 years, 13 years, 19 years, and 27 years. In the beginning stages the growth is essentially a superficial process with, according to Collins and Mayou, "a tendency to early growth forward in excess of its invasion of the tissues beneath, more so than in growths of a similar

character in other localities, the firm fibrous cornea and sclerotic are not easily infiltrated by the growth which tends to spread in the line of least resistance" (Pyle's *System*, p. 107).

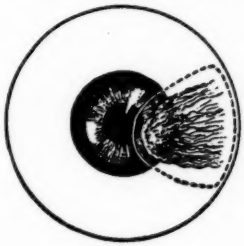

FIG. 1.

"The substantia propria offers some resistance to the invasion setting up a barrier of embryonic connective tissue around" the epithelial cells (*Am. Encyclopædia of Ophthalmology*, p.

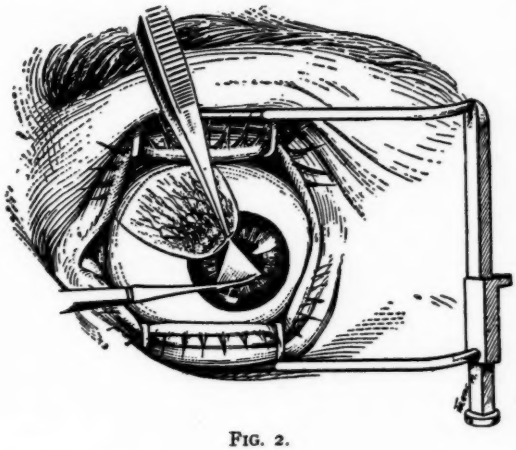

FIG. 2.

3363). According to Parsons (*Pathology*, vol. i., p. 145) "the corneal epithelium usually passes on to the growth unchanged, while the conjunctival epithelium passes into the tumor. The process gradually invades the substantia propria elevating Bowman's membrane. Posteriorly the episclera is gradually

invaded but there is some resistance encountered in the lymph spaces between the scleral lamina." According to the article in the *Encyclopædia of Ophth.*, "the fact that the canal of Schlemm and the anterior perforating vessels lie under the conjunctiva accounts for the fact that the growth should rarely become intrabulbar." This is in variance with the opinion expressed by Ginsburg and Parsons, although held by Axenfeld, Wintersteiner, Saemisch and Greef. The same article advances the theory "that the intraocular pressure prevents the

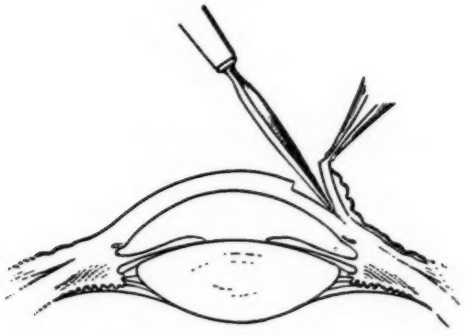

FIG. 3.

growth from breaking through elsewhere." (*Am. Ency. Oph.*, p. 3074.) LeGrange says that involvement of the lymph glands is rare but does occur. According to Parsons when convalescence does occur the preauricular are first affected.

From the above and from a summary of the opinion of pathologists one may deduce what clinical experience usually substantiates:

1. That epithelioma at the limbus is a relatively superficial process, with slight tendency to invade the deeper structures because of anatomical barriers.

2. It is relatively non-malignant in type, of slow growth, showing long rest periods.

3. There is no tendency to involvement of neighboring lymph glands.

Therefore, a tumor of this general type and behavior invites surgical attack with a fair prospect of success, in spite of the

statement made by Parsons and others "that there is a tendency to recurrence after removal."

Surgical interference in neoplasm of the limbus has the same object as surgical attack of malignant growth elsewhere in the body. The surgical problem is essentially the same: First: The removal of the diseased area in a well planned and thorough going way, until only sound and healthy tissue remains. Secondly: The preservation of the maximum of function and;

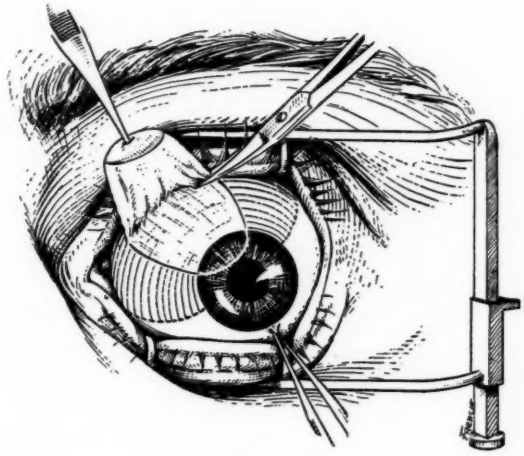

FIG. 4.

Third: The repair of the denuded area with sound tissue which will give proper support and strength.

The method of procedure employed in the cases to be reported has been the same.

With a strong keratome, an incision is made in the sound corneal tissue well in advance of the tumor border. This cut is made vertical to the plane of the cornea and extends down through the several layers nearly to Descemet's membrane and outlines the corneal extent of the growth as far as the limbus. By means of the keratome, the lips of the corneal wound is pried up until enough tissue has been elevated, to admit the firm grasp of a strong forceps. This corneal flap is peeled back by the aid of blunt dissection or the keratome until

the limbus is reached. Here it is easier to continue the dissection by means of sharp pointed scissors. The flap is continued backward toward the fornix including the episcleral tissue. A sufficiently broad wedge of conjunctival tissue with its base to the fornix is removed to surely include all thickened and suspicious tissue. The denuded surface is then carefully inspected and any suspicious tissue is removed by means of sharp scissors and forceps. The conjunctiva on either side, above and below, is then freely undermined by blunt dissection and the denuded area is covered with a thick flap of healthy conjunctiva.

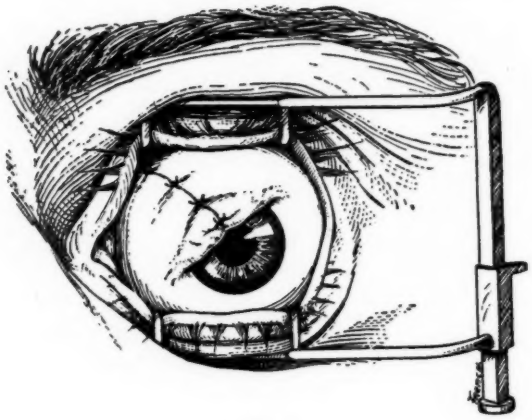

FIG. 5.

Because the purpose of this flap is one of support as well as repair it should include subconjunctival tissue. These flaps are held in apposition by twisted silk, preferably mattressed (note drawing shows single sutures). These sutures are permitted to remain until union has taken place, and may be removed on the fifth day.

CASE 2.—Fred C., age 76, of Ellicottville, N. Y., No. 8533, retired farmer. May 19, 1915.

History.—For about eight years has what he describes as a "kernel" on the right eye. He has experienced no difficulty, save periods of ocular irritation. General health—good. No venereal history.

Examination. — Vision: $\frac{6}{12}$. Wassermann — negative. Tuberculin—negative. In the lower temporal quadrant of the cornea from 6 to 9 on the clock dial, is an uneven growth, elevated less than a millimeter, which extends in an irregular curve forward on the cornea in width varying from 2 to 3 millimeters. The corneal tissue at the border of the growth shows an ill-defined cloudy zone in the stroma like that observed in pterygium. The superficial epithelium is intact save at the crests of three nodules: this being the only area taking fluorescin stain near the border. At the limbus, the growth appears thinner than on the cornea, but there is a wedge-shape area of thickened bulbar conjunctiva which is apparently continuous with the episcleral tissue underneath, in as much as the invaded conjunctiva does not move freely. The mass is striated with engorged conjunctival vessels which converge to the corneal cone. Iris—normal. Under local anæsthesia at the Buffalo General Hospital, the growth was removed according to the method described which included the entire wedge of conjunctival and episcleral tissue. The area covered with conjunctival flaps from above and below. Healing was prompt and kindly. Discharged in two weeks. Uncorrected vision: $\frac{6}{12}$.

Pathological Report.—Microscopic examination shows an irregular thickening of the epithelium, which is rather papillar in some places, and in other places dips down, destroying Bowman's membrane, and shows some slight infiltration into the substantia propria. The cells are irregular in shape, showing hyperchromatic nuclei and a few mitotic figures. There are certain areas showing marked subepithelial round cell infiltration with formation of new capillaries in the substantia propria. The tumor formation apparently remains superficial, and spreads laterally rather than a tendency to an infiltration of the connective tissue layer. Microscopic diagnosis-epithelioma.

On September 21, 1915, the patient presented himself for inspection. Healthy scar formation replaced the site of the epithelioma. However, on the lower nasal quadrant one millimeter behind the corneoscleral junction there was observed a small oval subepithelial nodule, apparently in the conjunctiva. This, along with a generous area of conjunctiva was excised and the episcleral tissue removed. The conjunctival gap was closed with silk sutures. This case was seen at intervals until his death at 81, five years later with no evidence of recurrence. Vision remained $\frac{6}{12}$ (uncorrected).

CASE 3.—Frank L., age 31, Jamestown, N. Y., No. 9648, metal worker. Seen on January 10, 1916. This case was

referred to me by Dr. H. S. Reger of Jamestown with the following history: Three years previously, he developed a sensation of foreign body in the left eye. A few days later noted an unusual appearance. There is no history of discomfort. Denies venereal infection. General health—excellent. Wassermann—negative. Tuberculin test O. T. negative. Tension normal to fingers. O.D.V. $\frac{6}{6}$. In the upper nasal quadrant of the cornea, extending from 8:30 to 1:30 on clock dial, is an irregular mass extending 5 millimeters on to the cornea at its widest point. There is a tendency to nodular formation. The superficial epithelium is intact, there being no staining with fluorescin. There is a faintly clouded zone in the cornea like that seen in pterygium. The mass apparently extends deeper into the stroma than the other cases seen. There are two leashes of conjunctival vessels, the smaller from above and the larger extending from the pinguicula to the center of the mass. The conjunctiva is thickened nearly to the caruncle and is only very slightly movable over the sclera.

Under local anæsthesia at the Buffalo General Hospital, the mass was extirpated as described above. In my anxiety to remove as much of the corneal tissue as possible, I perforated into the anterior chamber with tip of my keratome and a few drops of aqueous escaped. The wound was evidently a small one for the next day there was no leakage. The wound healed uneventfully.

Pathological Report.—Marked thickening of the corneal epithelium with areas showing a papillar formation. The cells are fairly regular, and while the nuclei are somewhat hyperchromatic, still this is not marked. There is no tendency to infiltration of the subepithelial connective tissue and mitotic figures were absent. There was marked proliferation of the subepithelial connective tissue, with new vessel formation and some infiltration with round cells. Diagnosis epithelioma, probably of a low degree of malignancy. The case was kept under observation at intervals by myself and Dr. Reger, being last seen by me in July, 1917, at which time there was a smooth flat flap of conjunctiva. Meantime, however, he has been under the observation of Dr. Edward Stieren of Pittsburg who kindly furnishes me with the following data under the date of February 18, 1921.

"In regard to Frank C., whom I first saw August 14, 1916, there was then and is at present a flap of conjunctiva covering the upper, inner third of the left cornea. The remaining cornea is transparent and clear as are all the media.

R. V. $\frac{4}{4}$ − homatropin. R. V. $\frac{6}{6}$ − : + 0.12 sp. $\bigcirc$ + 0.37 cy. ax. 45 V. $\frac{6}{6}$; L. V. $\frac{6}{12}$ − homatropin. L. V. $\frac{6}{15}$ + : +0.25

sp. ⊃ + 4.00 cy. ax. 55 V. $\frac{6}{5}$; 12 degrees of esophoria: 10 degrees left hyperphoria.

"There is a limitation of the left globe outwards and downward but he enjoys binocular vision having learned to turn his head to the left when looking to the left and depressing his head when reading. With this exception the eye does not give him the slightest concern.

"Enclosed please find the photographs taken of his condition. They are failures in my estimation as they make the conjunctival flap look as though it were raised which is not the case as it is perfectly flat and as pale as the conjunctiva surrounding it. The enclosed sketch shows the condition better.

"I think there will be no further contraction of the flap with consequent increase in astigmatism as his refraction has remained the same in the left eye for the past two years. It is interesting to note that at the first refraction September 2, 1916, there was but 1 D. of hyperopic astigmatism, axis 60."

CASE 4.—R. W. G., age 73, No. 16205, Mt. Alton, Pa., farmer. December 3, 1919. About seven years ago, patient noticed a small spot on the nasal side of his right eye which was irritated for a few weeks and then quieted down. At long intervals, the eye has been mildly uncomfortable but the patient has suffered no serious inconvenience. Lately, however, he is quite sure that the spot is increasing in size. This later observation is confirmed by his wife. No history of venereal infection, several healthy children. General health is excellent. Vision: $\frac{6}{12}$ + 0.75 sp. ⊃ + 0.75 cy. ax. 30; V. $\frac{6}{7.5}$, Wassermann—negative. Tuberculin O. T.—negative.

In the nasal quadrant of the cornea, extending from 2 to 5 o'clock, is a slightly elevated growth with small nodules. The growth is not movable. There is a narrow opaque cloudy zone in the deeper corneal layers, like that seen at the head of pterygium. The nodular edge takes a faint fluorescin stain. The conjunctival area is thickened and is slightly adherent to the sclera beneath but not immovable.

Under local anæsthesia, the mass was removed according to the technique outlined.

Healing was prompt. Patient was kept under observation two weeks and sent home.

I have seen him at varying intervals since. When last seen, a few weeks ago, there existed a firm white scar with no diseased tissue. Slight limitation of excursion of globe, outwards. Vision: $\frac{6}{7.5}$.

Pathological Report.—Marked thickening of the surface

epithelium in areas, with loss of epithelium in other areas. The cells were large, irregular, showing hyperchromatic nuclei, but no mitosis. In certain areas Bowman's membrane was entirely destroyed. There was slight subepithelial round cell infiltration. At the areas where the tumor cells were destroyed, there was some infiltration with polynuclear leucocytes.

Diagnosis.—Epithelioma of the cornea.

Summary.—Epithelioma of the limbus is usually of the slow growing non-malignant type, which in its early life remains superficial, with no great tendency to invade the deeper structures nor to metastasis. This type of neoplasm is favorable for surgical attack. The surgical problem is the same as for any other portion of the body: extirpation and replacement by healthy tissue. The technique employed on three cases reported endeavors to conform to surgical fundamentals.

CONCLUSION.

It is not the purpose of this paper to contrast the results of surgery with those obtained from radium, nor to minimize the brilliant results obtained with radium or underestimate its value. I am simply reporting the results of my experience with epithelioma of the limbus and presenting the surgical phase of the problem. I desire to express my thanks to Dr. Burt Simpson of the State Institute for the study of malignant diseases at Buffalo for the pathological reports and to Mr. W. C. French of Philadelphia for the illustrations of the surgical technique.

THE CORNEAL SUTURE IN CATARACT EXTRACTION.[1]

By Dr. E. C. ELLETT, Memphis, Tenn.

THERE are times in the experience of every operator when he must have felt that it would be a decided advantage to have a means of closing the generous incision into the eyeball that a cataract extraction demands, and many attempts have been made to devise such a means. These attempts have been one of two kinds, either the insertion of some sort of a suture in the ocular tunics, or in the preservation of some sort of a conjunctival bridge or flap to maintain a connection between the lips of the wound.

Sutures have been either conjunctival or corneal. Conjunctival sutures are usually meant to be inserted at the completion of the operation. If all has gone well, one does not need them, and if things have gone badly, it is much better not to prolong the manipulations by endeavoring to insert them. The same might be said of those forms of corneal suture which it is proposed to place after the operation is completed. Through and through corneal sutures have seemed so objectionable that I have never employed them, and cannot therefore discuss them. Of the forms of corneal suture placed on the "in and out" plan, my experience is limited to the technique proposed and practiced by Prof. Kalt of the Quinze-Vingts Hospital in Paris, and my interest in this technique followed a visit to his clinic in 1910, the favorable impression being strengthened by a second visit in 1913. Kalt's last paper, in the *Annales d'Oculistique*, June, 1910, contained a

[1] Read before Section on Ophthalmology, New York Academy of Medicine, April 21, 1921.

report of two thousand cases, a sufficient number to command respect.

The presentation of two papers on this subject on previous occasions, the last to the section on ophthalmology of the A. M. A., nine years ago, have been the media of expressing my personal impressions of the value of the corneal suture in cataract extraction, impressions which the lapse of time and added experience have not changed.

It seems to me impossible to carry out the technique satisfactorily unless one is provided with the proper materials, which I have not been able to obtain anywhere in this country. The needles are round, very fine, and perfectly pointed. The thread is a special one of silk or cotton, iron dyed, and a little finer than 00.

The method of placing the suture can be best described in Kalt's own words, and this description is quoted because it is exactly the procedure upon which the conclusions of this paper are based.

"I pass the needle into the cornea, in the vertical meridian, about 1*mm* below the limbus, the point, without penetrating into the anterior chamber, emerges at the juncture of the opaque border, and the thread is drawn through. Then the needle is introduced about 1*mm* above its point of exit into the episcleral tissue, as is done in the muscular advancement. As soon as I find that the point has penetrated into the resistant tissue I bring it out again, in order to involve as little of the tissue as possible. As it is impossible to bring the needle out at right angles, about 2*mm* of conjunctiva is loaded on it, which is of no consequence. In drawing this thread I leave a loop which is placed sideways toward the nose and spread out carefully to avoid twisting." "The whole forms a T, with a gap between the junction of the horizontal portion with the vertical portion." "An interval of .5*mm* corresponding to the limbus, is ample to permit the passage of the knife."

After placing the suture, it is well to have the lower end lie straight downward, the upper end straight upward, and the large loop lying on the nose well out of the way. The suture does not, of course, come in contact with the skin, but lies on the gauze mask which surrounds the field of operation. By wetting the thread with a sterile solution it can be made to

adhere to the gauze sufficiently not to curl up and get in the way.

The fixation, corneal incision, capsulotomy and delivery of the lens follow in the usual manner. Those steps, as well as the iridectomy, are according to one's usual technique. The incision at the limbus can easily carry a little conjunctival flap on each side of the stitch, but the apex of the incision is wholly free of conjunctiva.

In regard to the capsulotomy, Kalt uses the capsule forceps which bear his name. Sometimes they will fail to grasp the capsule, and a cystotome must be employed. Sometimes they grasp the capsule, which does not tear but gives a secure hold by which the zonule can be ruptured and the lens delivered in its capsule, as advocated by Stanculeanu, Arnold Knapp, and others. Usually a large portion of the anterior capsule is removed in the bite of the forceps, which facilitates the delivery of the lens and lessens the incidence of secondary cataract.

If one adheres to the Kalt technique, he will not perform an iridectomy. Full mydriasis before the operation renders it easier to do the simple extraction, and also lessens the tendency to iris prolapse. This unpleasant complication occurs, I believe, in from ten per cent to twenty-five per cent of simple extractions. In the last 1100 published cases, Kalt had it occur in 3%, but I have not been able to approach this result. In the 249 cases of extraction with suture of the cornea on which this paper is based, 223 were simple extractions, and prolapse of the iris occurred 24 times. I have counted as prolapse every case in which the slightest discoloration from uveal pigment occurred in the line of the incision. Sometimes it was a frank knuckle, visible the day after the operation. Sometimes it was a small point appearing several days after operation, and either remaining stationary for a while, and then receding, or increasing in size. An iridectomy was performed for prolapse of iris 15 times (6.75%).

Although a digression, it is probably proper to speak of the character of iris prolapse that may follow the operation with corneal suture. It is small and lies obliquely, to one side of the stitch. For some reason inflammatory action and the resulting adhesion is slow to take place, and if excision is done, it is easily done, and the pillars can be readily dressed back into

place, so that the coloboma, except for its oblique position, is quite as regular and satisfactory and pleasing to the eye as one deliberately made as a step of the extraction.

While the occurrence of iris prolapse may be explained by the physics of pressure of the aqueous, it is hard to tell why it occurs when it does. One of my early cases was a woman with chronic nephritis. On the night of the operation she had two uremic convulsions and was unconscious several hours, but she did not have an iris prolapse, and recovered from the uremia with a perfect cosmetic and visual result. On the other hand I recently operated on a most tractable and satisfactory patient, an old colored woman, whose behavior during and after the operation was above reproach, yet she had a small prolapse the day after the operation, which so increased in size by the next day that excision was considered advisable. To digress a little further, it is a surprise to see prolapse occur a week or more after satisfactory reëstablishment of the anterior chamber, and this is usually, I think, due to some traumatism, which will not always be confessed.

As soon as the lens is delivered, the suture is drawn up and tied. I prefer to tie the first twist double, the so-called surgeon's knot, since it does not slip. A loosely tied suture is of no use, and it is well to tie it tight enough to produce a little wrinkling or puckering of the cornea. It has been argued that a suture passed in this way will, when tied, produce an inversion of the edges of the wound, but this has not been my experience, as the cornea is stiff enough to prevent it.

Should there be at the time of delivery of the lens, a loss of vitreous, one of the great advantages of the stitch is manifest. Vitreous loss is, of course, a thing which is viewed with varying concern, but probably most of us prefer not to lose any vitreous, or if we must lose it, prefer that the loss be small, and that we do not have to leave the eye with a large bead protruding from the wound. The good results that follow in many such cases are well known, but that does not alter our chagrin at the accident. To see the protruding bead recede, and the edges of the wound approximate as the suture is tightened is a most gratifying experience, and a sight that would make many converts to the use of the stitch. As Kalt says, "Once the suture is tied, one is master of the situation."

The toilet of the wound is now made. As a factor in making possible a safe, deliberate and thorough toilet of the anterior chamber and wound, lies the strongest appeal of the corneal stitch. It is generally believed that nothing so contributes to the prompt and uneventful recovery of an eye after a cataract extraction as the thorough removal of all lens matter. It does not seem possible to avoid leaving some of it behind in delivering the lens unless the lens is removed in the capsule. If some remains, as is usual, the removal of this material is accomplished in various ways by different operators, manipulation with spatulæ, irrigation, and the use of the suction curette being the more usual ways. The latter is the method employed by Kalt, and since the wound is closed by the suture, it seems the easiest plan under the circumstances. It appeals to me as more exact and expeditious, and attended with less disturbance to the eye than the other methods. The suction is continued till the pupil is clear and black, when the iris is dressed into position, and the conjunctival flaps, if any, are smoothed out. Not only is thorough removal of all lens matter at the time of operation a factor in lessening the post operative reaction, but it also seems to lessen the incidence of secondary cataract. The secondary cataract is, of course, largely composed of capsular remains, but cortical debris, and the inflammatory products which result from any considerable reaction add to the density of the membrane. It has seemed fair to attribute the small number of secondary operations in this series to the careful toilet which this technique permits. In the 249 cases, a secondary operation was performed 42 times. The exactness of these figures from a percentage point of view is discounted by two factors, one being that certainly some of the cases should have had secondary operation which did not have them, and in some of the cases more than one secondary operation was done. A few of the secondary operations were done, not for capsular opacities, but for adventitious hyaloid membranes.

The operation completed, the customary dressings are applied and the patient returned to bed. The cases in this series were inspected at the end of 24 hours, and usually the anterior chamber was found to be reformed. The patient was then permitted to get up and the dressing left off the unoperated eye, provided it possessed any vision. This practice may not

meet with general approval, but it was followed in these cases without there being any cause for regret.

At the end of 48 hours the eye is again dressed and the stitch removed. This is done with local anæsthesia and with the patient lying down to guard against any sudden movement when the stitch is drawn upon, as it must be in its removal. This little maneuver is executed with due regard to cleanliness and gentleness, and with the eye anæsthetized and properly illuminated. The stitch is removed at this time because it has served its purpose, and it is best to get rid of it. It might be removed sooner, it might be left in longer, and sometimes is. It is rather surprising that it causes so little irritation. One case, operated on in June, left the hospital for some reason without having the stitch removed, and returned in November, five months later, for a secondary operation, the corneal arm of the stitch having cut through, but the loop still hanging to the eye, attached by its scleral portion. The eye was only slightly red, and no ill effect had been occasioned by the long retention of the stitch.

It is argued that the removal of the stitch is practically a second operation, disturbing, terrifying and full of risk. It need not be. It is not necessary to tell the patient that he has a stitch in his eye that must be removed till the time comes to remove it, and the stage is set. The announcement then causes no surprise, since to the lay mind stitches and wounds are closely related, and it seems not unnatural that one has been necessary in this wound.

It has happened that sudden movement or squeezing of the lids has emptied the anterior chamber of aqueous during the removal of the stitch. I do not recall any serious results from such an accident. In any event, the dressing is reapplied after removal of the stitch for at least another twenty-four hours.

It has been thought that the presence of the stitch would not only increase the irritation, but even favor infection of the eye. In a good many of these cases the stitch was transferred at once, upon removal, to a tube of culture medium, and in no case was anything grown more formidable than a staphylococcus. The eyes in which the stitch is used show no more irritation than other operated eyes, and as regards infection there were two eyes lost in the 249 from this cause, which is about

the average percentage. In another case, a ward patient, up and about and with no dressing on his eye, washed his face at a sink and fished some soiled surgical dressings out of a waste can and wiped his face on them. The eye became infected and was lost, but it seemed hardly fair to attribute this to the operation.

It might be well to recapitulate here a sort of statistical table of the cases of extraction with corneal suture on which this paper is based. They were, as has been stated, 249 cases. Of these there were 54 in which no record of the visual result was made, for reasons that will obtain in any series. Of the eyes in which the vision was recorded, the following were the results:

20/20—71 cases			20/80— 3 cases	
20/25—46 "			20/100—5 "	
20/30—19 "		Less than	20/200—2 "	
20/40—20 "			P. L. 3 "	
20/60—15 "		No vision	7 "	

The eye was lost from suppuration in two cases. One eye was enucleated for subchoroidal hemorrhage, iridocyclitis and sympathetic ophthalmia in the other eye. One eye was enucleated for iridocyclitis and secondary glaucoma. Eight eyes showed marked iridocyclitis.

There was loss of vitreous in 18 cases.

Prolapse of iris in 24 cases.

Sixty of the cataracts were immature.

Thirty-two lenses were extracted in the capsule.

Forty-two secondary operations were done.

In 223 cases, simple extraction was performed. Excision of prolapsed iris was done 15 times (6.7%).

The cases were not selected, but were those in which the operation was not deemed inadvisable for any reason. Those reasons will not be discussed because I am not prepared to state any contraindications for the use of the suture, though its use may be inexpedient. For instance, I would not use it when the removal of the stitch would have to be left to inexperienced hands. Kalt says it is indicated in all cases except those showing posterior synechiæ, but at my last visit to his clinic I noticed cases in which it was not used whose records

had a note of "lachrymation." I did not have an opportunity to discuss this point with any member of his staff.

What, then, may be said against the operation with corneal suture, and what advantages can be argued in favor of its use. The objections to the suture are that it adds a step to the operative manipulations in its introduction, and another in its removal. In these respects the insertion of a suture is open to less objection than the performance of a preliminary iridectomy, a procedure which is considered justified in many cases. I do not think its presence increases the irritation following the operation, or the liability of infection. Kalt says the suture is contraindicated by posterior synechia.

The advantages of the suture are:

1. It reduces the likelihood of vitreous loss, or at least of considerable vitreous loss, to a minimum.

2. It permits simple extractions with a smaller percentage of iris prolapse, or if iris prolapse occurs, it limits its extent.

3. It promotes early closure of the wound, and enables the patient to get out of bed earlier.

4. It enables one to make a more thorough and deliberate toilet of the wound. In this way it lessens the incidence of secondary cataract, and also encourages and justifies operation in immature cataracts. If it can be made generally known that some immature cataracts are safely operable, it will tend to reduce the number of patients who are advised to wait until the cataract is ripe before they seek relief, and the result will be to bring many patients with preventable blindness to consultation at a time when relief is possible.

CONGENITAL ATRESIA OF THE PUNCTA LACRIMALIA OF ONE SIDE.

By Dr. HARRY GRADLE, Chicago.

CONGENITAL closure of the conjunctival openings of the lacrimal canals is reported to be fairly common, but descriptions of such anomalies do not appear very frequently in the literature. Manz wrote that in several instances, the puncta lacrimalia were found closed by a fine membrane, although the tear passages proved to be permeable. In the second edition of the same Encyclopedia, von Hippel mentions that there has been described an atresia of the puncta with patent canaliculi and normal relations of the remainder of the tear passage. The resultant epiphora was relieved easily by simple perforation of the epithelial cover that closed the mouths of the canals. Hansell claims that congenital absence of one or both puncta is fairly common, but does not differentiate between atresia and complete absence. None of these authors cite either cases or case reports to substantiate their statements. Individual cases of congenital atresia of one or more puncta are reported by Ferron, Nielsen, Lebegne, Bernhardt, and Webster Fox. The case reported by the latter author was of particular interest because of the lack of epiphora for more than twenty years, despite complete congenital absence of both of the lacrimal points of one side.

The following case is the only one of this character that I have ever seen:

> Miss W., a nurse, age 21 years, complained of continuous lacrimation of the left eye. This condition had been present since her earliest recollection. There was no discharge from the eye and the lacrimation was excessive only under very irritating conditions of wind and weather.

The right eye was normal in every respect. Neither upper nor lower lids of the left eye showed any thickening or abnormality whatsoever. The conjunctiva, both tarsal and bulbar, was normal. The lacrimal puncta were seen as small dark points in the normal location. Attempts to insert a punctum dilator were unsuccessful. Under three diameters magnification, the openings of both upper and lower puncta were found to be covered with a thin layer of normal epithelium, some few cells thick, such as is found along the margin of the lids. This epithelial covering was broken with the point of a Graefe knife, held at right angles to the lid margin, and twisted upon its own axis, after the point had been forced through the epithelium. A punctum dilator was then inserted and the lacrimal points enlarged. Lavage with salt solution showed a clear passage into the nose, both from upper and lower puncta.

Three days later, she reported that only on one occasion had there been any overflow of tears. The dilatation of the puncta and lavage were repeated, but it was unnecessary to use any sharp instrument as the puncta had remained patent. This relieved the epiphora and there has been no return of that condition during the past four months.

This congenital atresia was evidently due to a failure of perforation of the lid epithelium before birth. In the embryo about six weeks old there is found a naso-lacrimal groove. This lies in the position that in the adult would correspond to a line drawn from the internal canthus to the junction of the lip and the cartilaginous ala of the nose. From the deepest epithelial cells of this groove, a cord of ectoderm, corresponding to the lacrimal passage, arises and forms a lumen. The lower end opens into the nose, while the upper end divides into two passages that eventually open into the puncta lacrimalia. At first these lie near the middle of the palpebral fissure, but are gradually drawn toward the internal canthus, pushing before them tarsus and conjunctiva. By the time the puncta have assumed their position of adult life they have gathered a mass of tissue before them which develops or rather retrogrades to form the caruncula lacrimalis. The naso-lacrimal groove eventually disappears.

The condition is not serious and merits but little discussion. In the treatment the endeavor should be to do as little as possible consistent with the restoration of function and slitting

the canaliculus, a procedure that is indulged in altogether too indiscriminately, is entirely unnecessary.

BIBLIOGRAPHY.

BERNHARDT. Rostock, 1907. Ref. *Klinische Monatsblaetter f. Augenheil.*, Nov., 1908.
FERRON. *Bull. Soc. d'Anatom. et de Physiol. de Bordeaux*, 13–87.
GRADLE. *Amer. Encyclopædia of Ophthal.* "Development of the Human Eye," vol. v.
HANSELL. *Amer. Encyclopædia of Ophthal.* "Anomalies."
VON HIPPEL. *Graefe-Saemisch.* II Edition. Chap. IX.
LEBEGNE. Paris *Thesis.* 1910.
MANZ. *Graefe-Saemisch.* I Edition. Chap. V., p. 113.
NIELSEN. Bordeaux *Thesis.* 1872.
WEBSTER FOX. *Ophthalmic Record.* 1900.

REPORT OF THE PROCEEDINGS OF THE SECTION ON OPHTHALMOLOGY OF THE NEW YORK ACADEMY OF MEDICINE.

By Dr. CONRAD BERENS, Jr., Secretary.

MEETING OF FEBRUARY 21, 1921. DR. L. W. CRIGLER, CHAIRMAN.

Doctor C. R. Stockard, Professor of Anatomy, Cornell Medical College, read a paper, **The Eye in Normal and Abnormal Development.**

The eye is the first actual organ to make its appearance in the embryo. In the early embryo the ectoderm of a definite region thickens to outline the future central nervous system, and in the antero-median portion of this neural plate the optic fundament arises. As the neural plate folds its lateral borders upward the optic vesicles grow ventro-laterally as diverticula from the neural tube. The optic vesicles thus appear before the primary brain vesicles have widened out. The early optic vesicles are proportionately of enormous size and evidently a considerable amount of developmental energy is consumed in their origin and outgrowth from the embryonic brain.

These early organs constituting a large part of the entire embryo are the simple beginnings of only the retinal portion of the eye. The fundament of the crystalline lens very soon arises from the skin ectoderm overlying the optic vesicle, and the lens and optic cup then continue their development in close association. From this time throughout embryonic life and during almost all of fœtal existence, accessory parts are being added to the primary retinal cup. Few organs in the body are so continuously adding to themselves and undergoing such important developmental processes through so extensive a period as is the eye.

During this long developmental time the central portion of the retina is differentiating its numerous cell layers. The anterior periphery beyond the ora-serrata becomes modified to form important portions of the corpus ciliare and pars iridica. The mesenchyme surrounding the retinal cup is continuous with the mesenchyme of the cornea and from it is derived the choroid coat, the sclera, the tunica vasculosa lentis, and portions of the corpus ciliare and iris. The lids, conjunctiva, lacrimal glands and other accessory glands and ducts originate from the overlying skin. Muscles destined to move the eyeball and lids are at this time being differentiated from the mesoderm, and nerves and vessels are growing out and forming to supply these numerous parts. The fibers from the retinal ganglion are growing in a direction to focus on the optic stalk and these fibers then follow the stalk back into the brain producing the optic nerves and primary optic tracts. From the brain cells about which these fibers end other fibers grow away and pass as the secondary tracts and optic radiations to the cortical centers of vision.

The large size of the primary eye, the numerous structures which become secondarily associated with it in development, and the long embryonic period during which these structures arise and differentiate, tend to render the eye liable to numerous arrests and defects in its development.

In studying experimentally the development of a number of organs I have found that unfavorable environmental conditions tend to slow in particular the rates of development of those organs which are rapidly forming at the given moment. An organ is most susceptible at the instant of its origin. When the embryo is subjected to a low temperature or deprived of oxygen at a certain developmental period, those parts which are then developing most rapidly will be injured, while other parts which are developing slowly will escape marked injury. If an early embryo be subjected to a low temperature at the moment when the optic vesicles should arise from the neural tube the vesicles will be suppressed. When such an embryo is returned to a favorable temperature it resumes development, but is either entirely unable to develop the optic vesicles or else it develops them in an abnormal fashion. This simple experiment permits one to induce complete anophthalmia,

microphthalmia, monophthalmia asymmetorica, or cyclopia. Arresting development at later periods will modify the expression of accessory parts of the eye.

On account of the long developmental time during which the various parts of the eye are being formed, it is rather difficult to interfere to any marked extent with the embryonic development of an individual without in some way injuring the eye. Thus the final condition of the eye becomes a most valuable index in estimating the degree of perfection in the development of an individual. Almost any arrest which the developing embryo may have suffered will show its effect in some manner on the ophthalmic structures.

Since in origin the eye is actually a portion of the brain or central nervous system, its quality of development is intimately associated with a similar quality of development on the part of the central nervous system. Thus in degeneracy of the nervous system and maldevelopment of the brain, in feeblemindedness and similar congenital conditions, one would anticipate certain structural defects in the eye, or at least an eye below the normal in its functional capacity.

Through experimental studies the writer has found that almost all of the accessory parts of the ophthalmic apparatus, crystalline lens, lids, conjunctival sac, lacrimal glands, extrinsic muscles, 3d, 4th, and 6th nerves, secondary tracts, etc., are capable of arising and differentiating normally in complete absence of the primary optic cup or retina. The forces regulating the normal adjustment and coördination of these parts in the presence of the retina are not fully understood at the present time. It is hoped that after more complete and detailed analysis the experimental studies of the development of the eye will furnish valuable explanations of many frequently found ophthalmic deficiencies.

DISCUSSION: DOCTOR E. UHLENHUTH agrees with Doctor Stockard as to the importance which the lowering of the temperature has in the development of certain organisms. In the case of the fish exposure to low temperature, at a certain stage, and the interruption of development resulting from it leads to the formation of structures pathologic in that they decrease the fitness of the organism for life. In other species, however, exposure to low temperature results in structural changes

which do not reduce the individual's fitness for life and may lead to the production of new races. Such is the case with the larvæ of the tiger salamander. The chemical processes causing development of different structures are not equally retarded, in this species, by exposure to low temperature, a condition which frequently occurs in the natural habitat of this species. Thus, by exposure to low temperature, development of certain organs of the larvæ of the tiger salamander is retarded more than the development of other organs, and an organism results in which some organs possess adult structures, while others are in a completely larval condition. Since the development of a peculiar mechanism necessary for the function of the thyroid gland is especially much retarded, these animals, as a whole, may remain infantile, while the sex organs which are among the least retarded structures, may, at the same time, reach maturity. Consequently exposure to low temperature, in this species, gives rise to a peculiar race defective in many ways as compared with normal animals, yet perfectly fit for life and even capable of reproduction.

Doctor Stockard explains the anomalies of the fish eye and the formation of double monsters on the ground that the entire process of development is composed of a series of successive budding processes. In accordance with Loeb's findings in the plant Bryophyllum calycinum he explains the normal succession of these budding processes by assuming that each bud at the time of its formation attracts, by some peculiar mechanism, most of the growth-promoting substances available in the embryo and thus by depriving them of the necessary substances prevents, for a time, growth of the other buds. If at this time the activity of the growing bud is checked by exposure to low temperature, the bud, after being returned to normal temperature, is not able to regain its dominance over the other buds and consequently the organs which develop from the suppressed bud become defective, the other buds growing out precociously and taking in their turn some of the substances which would have been necessary for normal development of the suppressed bud. One of the most peculiar budding processes is the regeneration of the amphibian lens in that this organ, after its removal from the eye, always regenerates by the formation of a bud growing from the upper

edge of the iris in a downward direction. The latter peculiarity has been claimed to be the expression of the forces of gravitation. I have shown, however, that this assumption is incorrect; for if the eye is inverted by transplantation, the lens again grows, after it has been extirpated, from the normal locus, now the lower edge of the iris, and thus regenerates against the forces of gravitation, in an upward direction. Hence I am inclined to assume that the upper edge of the iris represents the apex of the bud which, in the development of the eye, gives rise to the eye cup, and that the remaining edge of the iris although capable of the regeneration of a lens can not give rise to a lens because the apex located in the upper edge of the iris like the apex of Bryophyllum calycinum (Loeb) or, at definite times, the buds along the main axis of the fish embryo, is capable of attracting quickly the substances necessary for growth and thus gains an advantage over the other places of the edge of the iris before they can grow out. In the light of Doctor Stockard's experiments it appears to me that this assumption could be tested very effectively by exposing the animals, soon after the extirpation of the lens, to low temperature, as this procedure should prevent the upper edge of the iris from regaining its advantage over the other parts of the iris, when the animals are returned to normal temperature, and consequently lenses should regenerate from several places of the iris after a temporary stay in low temperature.

Doctor Stockard has laid special emphasis on the quantitative changes of metabolism resulting from lowering the temperature, which he believes to be the real cause of the specific changes of the structural expression following the lowering of the temperature. This assumption deserves special attention as our interest in the action of the morphogenic hormones centers at present precisely in the question whether these hormones produce all the innumerable structures characteristic for the action of them by bringing about specific changes in the kind of metabolism or by merely changing the rate of metabolism. The latter mode of action has been emphasized especially in the study of the thyroid action.

Doctor Stockard has pointed out that the structures of the eye require an especially high metabolic rate for their expression and that consequently all factors lowering the rate of

metabolism readily lead to disturbances in the development of the eye. That this is the case has been shown many years ago by Jacques Loeb who was able to produce blind fish by cutting off the oxygen supply. It is well known that lack of the thyroid function likewise results in a characteristic and considerable lowering of the metabolic rate. For this reason one feels much tempted to explain the atrophy of the eyes of the blind Texan cave salamander (*Typhlomolge rathbuni*) on the basis of the lack of the thyroid gland prevailing in this species of salamanders rather than by assuming that lack of light could have suppressed eye development in this cave-dwelling animal.

In this connection it should be remembered also that E. Steinach was recently reported to have abolished senile cataract by reviving the activity of the interstitial gland, a procedure which likewise results in a general rise of the metabolic activities of the organism.

Dr. Fridenberg said that he thought ophthalmologists are interested in biological rests, particularly with pigment abnormalities. For example, retinitis pigmentosa, retinitis pigmentosa sine pigmento, albinism, other changes (blue scleræ where bones are brittle, congenital corneal defects, maldevelopment of lens, in heterochromia). In endocrine organs we may find the key for many of these changes.

Dr. Stockard in closing the discussion said morphology and biology are equally important. Every morphologist must be an analytical biologist. All biological things have a morphological background. If we know structural reasons for a thing, we are beginning to get to the bottom of the problem. He believes morphology is in its infancy and we should get to a structural background even in pigment abnormalities. Nothing is really biological until it is first morphological or has a structural basis.

Dr. C. E. Ferree and Dr. G. Rand, Experimental Psychologists at Bryn Mawr College, read papers on (I.) **The Variable Factors which Iufluence the Determination of the Color Fields** and on (II.) **An Illuminated Perimeter with Campimeter Features.**

I. The variable factors which influence the apparent limits of color sensitivity are the wave-length and purity of the stimulus, the intensity of the stimulus and the visual angle,

length of exposure of the eye, the method of exposure (moving or stationary stimulus), accuracy and steadiness of fixation, the intensity of the general illumination of the retina and its state of adaptation, breadth of pupil, and the brightness of the preëxposure and surrounding field. The most important of these from the standpoint of the office and clinic are the intensity of the stimulus, the brightness of the preëxposure and surrounding field, the intensity of the general illumination, and the accuracy and steadiness of fixation.

By a sufficiently wide variation of intensity alone the fields of color sensitivity may be made to have almost any breadth within the field of vision, to differ radically in shape and even to change or reverse their order of ranking as to breadth. The limits for pigment stimuli may be either interlacing or concentric in the order from widest to narrowest of red, blue, and green; or of blue, red, and green; depending upon the intensity of light falling on the perimeter arm. Without great precision in the control of intensity, it is obvious that reproducibility of result can not be obtained and little significance can be attached to extent or shape of field, to order of ranking as to breadth of field, or to any variations from time to time or from person to person in these important features.

II. This instrument was devised in response to a request made by the American Ophthalmological Society for a feasible means of illuminating the perimeter arm with light of a good intensity and quality, so that every point on the arm in any meridian in which it may be placed shall receive equal intensities of light. Intensity and quality of illumination, however, are only two of the factors which influence the results of the perimetric determination. In devising the instrument described in this paper, it has been the purpose of the writers to provide a control also of other factors which are of importance in the work of the office and clinic.

Other novel features of the instrument are a tangent screen for the mapping of the normal blind spot and for the quick detection and mapping of central and paracentral scotomata, and a device for controlling the fixation of patients who have a central scotoma or pathological blind area. The tangent screen can be quickly and conveniently attached to the stimulus carriage and moved into position. When adjusted for work it

is the same distance from the eye as is the perimeter arm in taking the fields and receives at the point of work always the same uniform illumination.

DISCUSSION: DR. J. W. WHITE has always felt that the fields we took for color were not valuable as we took them. For seven years Dr. Duane and he have not taken color fields. They have depended upon the field for form. They use the blind spot for holding fixation where central scotomata exist, when taking the field on the tangent curtain or, preferably, the complimentary color test which could be used on the perimeter as well as on the curtain.

Dr. FRIDENBERG suggested stereoscopic fixation and spirit level for determining the horizontal.

MEETING OF MARCH 21, 1921. DR. L. W. CRIGLER, CHAIRMAN.

DR. KNAPP presented a case of **deformity of eyelids following anthrax.** The patient, aged 16, on December 23, 1920, noted a pimple in the lower eyelid. This was rapidly followed by a great swelling of the lids, fever, and prostration. As there was discharge from the nose a frontal sinusitis was diagnosed and an operation attempted by a rhinologist. After making the incision the subcutaneous tissue was found unusually dry. The operation was stopped and a culture taken, which gave anthrax. Antitoxin was given intravenously and locally about the swollen lids.

Two weeks later, there was an area of gangrene involving both lids, joined together at the outer angle in the shape of a horseshoe. This became demarcated and sloughed away, so that at present the lower lid is entirely gone, except for the line of eyelashes, which is directly adherent to the orbital margin; the upper lid is about half its normal size and the skin at the external angle is a congested, thin, atrophic scar. The eye, except for chemosis of conjunctiva, is normal.

Suggestions on the proper restoration of the lower lid were invited.

DISCUSSION: DR. WHEELER said that he thought it would be possible to correct the deformity of the left lower eyelid by a graft from the right upper lid. It is possible to take a graft from the upper lid 50*mm* long and 20*mm* wide, and it is not

necessary to allow for contraction as is the case with grafts taken from other locations. He suggested deferring the repair of the shortened upper lid in order to get the benefit of the exaggerated suspension afforded by the contracted upper lid, after adhesions are made between the lid margins. There is considerable depression connected with the deformity in this case, and it is a suitable case for turning a pedunculated flap from the temple, if it does not seem wise to use the detached graft.

DR. FRIDENBERG said he used a Wolf graft in case of severe burn and suggested its use as there was less chance that the lid would be drawn out of position by subsequent contraction.

DR. J. M. WHEELER showed a case of **Unilateral pulsating exophthalmos. Peculiar enlargement of the sella turcica. Development of bruit four years after accident.**

The patient (A. F. G.) is a male, 31 years of age, a truck driver. He was in a motorcycle accident on October 24, 1914, at which time he fractured his jaw. Transient right facial paralysis and right ptosis followed the accident. Recovery from both was complete, but an annoying diplopia resulted which lasted for 6 or 7 months. Again, in the fall of 1916, following physical exertion, there was an attack of diplopia, which persisted for about 6 weeks. In April, 1918, he enlisted in the army and was discharged December 22, 1918. Two days after discharge, he became ill of pneumonia, and during recovery, the patient developed diplopia again, accompanied by a distressing bruit. Both diplopia and bruit have persisted to this time, but both are becoming less and less troublesome. The patient is driving trucks successfully. At irregular intervals since the bruit developed, there have been attacks of blindness in the right eye, each lasting 3 or 4 minutes.

Present Condition: Vision is $\frac{20}{20}$ in each eye without correction. There is marked dilatation of the bulbar conjunctival vessels, particularly the veins, worse in the left eye. The pupils are equal in size and have normal reactions to light and accommodation. The retinal veins of the left eye are dilated but not tortuous. Otherwise, the interior of each eye appears normal. There is no appreciable dilatation of the veins of eyelids, forehead, or face. There is complete paralysis of the left 6th cranial nerve, with resultant convergent strabismus.

The Hertel exophthalmometer readings are for the right eye *17mm* and for the left *21mm*. There is definite palpable pulsation of the left eye, and this becomes visible under slight pressure by the fingers. When the patient leans forward, there is no increase in the exophthalmos. There is a distinct bruit heard everywhere over the head, possibly loudest over the left mastoid region. The bruit can be made to disappear by firm pressure on the carotid. The blood pressure is systolic 115, and diastolic 65. The Wassermann test is negative. The patient is relatively comfortable when he remains quiet, but feels weak and is annoyed by the bruit when he exercises. Dr. George S. Dixon has submitted the following interesting X-ray report: "I beg leave to report in the case of Anthony Gargan that his sella is large, measuring on the plate *12mm* deep x *18mm* antero-posteriorly. Measured by the planimeter, and corrected for distance the content is *150sq.mm.* The dorsum shows considerable erosion behind, including the base of the posterior clinoids, but while they are thin they still retain a long forward curve. That is to say, whatever has been happening, the pressure has been down and back, acting on the posterior part of the dorsum and base of the clinoids without apparent excessive pressure on the upper part of these processes. His frontals are clear and of moderate size. His ethmoids are thickened. The nasal septum is badly deviated to the right. The right antrum is fairly clear, the left cloudy. The lateral plates show all sinus regions cloudy."

There are two important questions which arise for answer. One is whether or not it is advisable to operate for the paralytic strabismus, and the other is whether operation for ligation of the internal or common carotid artery of the left side should be done. Optic atrophy, partial aphasia, and loss of life have been reported as a result of ligation of the carotid, and in many cases only temporary reduction or disappearance of the bruit has resulted.

DISCUSSION: DOCTOR ARNOLD KNAPP thought that treatment depended upon the patient's symptoms. If he was annoyed by his symptoms the prospects of relieving them by an operation, ligature of the common carotid, were good. He thought it would be a mistake to operate for correction of the strabismus if an operation of ligation was going to be under-

taken, as he regarded the ocular paralysis as a mechanical one following the vascular disturbances in the cavernous sinus.

Dr. Wheeler in closing the discussion said that permanent obliteration of the bruit by ligation of the carotid is not at all a certain thing; as near as one can judge from the literature on this subject, permanent cessation of the bruit from ligation has resulted only in the minority of the cases operated on. Furthermore, with the possibility of optic atrophy, partial aphasia, or even death, the advisability of this procedure is questionable, and Doctor Wheeler said he should not consider this a slight operation.

Dr. J. H. Dunnington reported a case of **melanoma of limbus.** The patient (E. R.) is a school boy, aged 15. Following an attack of measles at age of 5, parents first noticed a black spot in the right eye. General physician was consulted, and he reassured them, saying it was simply an unabsorbed blood clot. There was no eye involvement occurring in the measles attack, and no medication other than boric acid was used in the eyes. The mother is confident that no spot existed in the right eye prior to the illness. There has been no appreciable change in size or character of the spot since it was first noticed.

Findings: Vision in the right eye is $\frac{20}{200}$, correctible with a high astigmatic lens to $\frac{20}{40}+$. The interior is normal. There is a heavily pigmented triangular shaped area at the limbus in the lower nasal quadrant. The pigment is irregularly distributed being heaviest at its conjunctival base. The uneven distribution of the pigment gives the spot a smeared appearance as if paint had been daubed with a brush. It measures $3\frac{1}{2}mm$ in width at its conjunctival base but narrows to a point as the cornea is invaded. It extends $3\frac{1}{2}mm$ into the cornea and involves the more superficial part of the parenchyma. It is $7\frac{1}{2}mm$ in length from corneal tip to conjunctival base. The left eye is normal in every respect.

There is a brownish pigmented band around the waist about 3 inches in diameter extending on the left side from midline in back to midline in front. No other pigmented spots on the body or extremities.

Fuchs refers to the occurrence of pigmented spots in the conjunctiva. The most common location is at the limbus. He is of the opinion that while in themselves they are not harm-

ful, they manifest a tendency towards development into melano-sarcomata. These pigmented spots consist of nests of pigmented cells deposited in the conjunctival epithelium. This proliferation of epithelium may assume glandular form. However, in event of growth of these melanomata, the sarcomatous elements proliferate very rapidly and the growth becomes a melano-sarcoma. Parsons described a congenital pigmentation of the cornea as result of an intra-uterine inflammation, causing deposition of uveal pigment into corneal layers. These congenital pigmented corneal spots are usually bilateral and centrally placed.

DISCUSSION: DR. LAMBERT agreed with Dr. Dunnington in his decision to keep the patient under observation.

DR. L. W. CRIGLER asked whether the conjunctiva was movable under this pigment, as he believed this an important point in the prognosis.

DR. A. WIENER presented two cases in which the **cornea had been tattooed** according to the method of von Blascovics. This method which is fairly recent gives most excellent results. One marks out the area either with a trephine or knife, denudes it of the epithelial layer, and then makes his incisions into this area at an oblique angle to the cornea. This should be done only in two directions, and at a right angle. Four or five made in this way suffices. The pigment used is obtained from the soot of a burning candle. This is rubbed into the incisions by means of a spatula moistened with the tears of the patient. A perfectly black pupil is obtained, with only a minimum amount of reaction. The eye can be uncovered on the second day. To those who are interested, the original article by von Blascovics can be read in the *Klin. Monatsblätter für Augenheilkunde*, July number, 1920.

DISCUSSION: DR. H. H. TYSON stated that he disagreed with Dr. Wiener as to the corneal epithelium sloughing off in the other methods of tattooing when the epithelium was not removed, and that if it did it was due to faulty technique. He said that he never removed the epithelium intentionally, and having operated with the Tyson Tattooing needle in about twenty cases, he had never had sloughing occur. He saw nothing new in this operation, unless it was the use of tallow soot instead of the Chinese India ink. In the two cases pre-

sented the results were excellent and if the pigment was retained for an extended period they would be all that could be desired. The principal complications of the tattooing operation were (a) the danger of forcing the pigment into the anterior chamber, with probable loss of an eye following; (b) secondary glaucoma in those cases in which an adherent leucoma or anterior synechia exist. In tattooing over the location of the adherent iris, one always produces pain notwithstanding the local anæsthesia, and a mild controllable increase in tension follows, which subsides under the use of miotics. In tattooing, if the pigment is forced into the corneal tissue in an oblique direction, as it should be, most of it will be retained, otherwise it will disappear in a short time. If the Tyson needle is used the first complication mentioned, penetration of the anterior chamber, should never occur, as the needle was devised especially to prevent its occurrence. With proper precautions and asepsis, he considers the operation safe and simple.

DR. FRIDENBERG spoke of a method used recently, of partly removing a flap by means of a trephine and then putting the flap back in position over the ink.

DOCTOR WIENER found, in regard to making a flap, that this was not always an easy matter nor satisfactory. The advantage of the soot taken from the burning candle, is that it is easily obtained absolutely sterile, and equal in every way to the best Chinese ink pigment.

DR. M. URIBE TRONCOSO read a paper on **Recent Methods of Examining the Angle of the Anterior Chamber** for which he suggested the term Ophthalmogonioscopy, and which he regarded as being more comprehensive than "ophthalmoscopy of the angle of the anterior chamber" as called by Salzmann, because other instruments besides the ophthalmoscope can be used for the inspection of the angle. He reported the history of the method, tracing it back to Trantas in 1907, but gives the credit for the decisive step which enables the observer to see all eyes, to Salzmann (1914–1915) who uses a contact glass upon the cornea.

A further improvement has been brought out by Koeppe, who devised a new contact glass provided with a water chamber which must be filled with a saline solution. Koeppe uses instead of the ophthalmoscope the new stereoscopic loupe made

by Carl Zeiss (Jena) called "Bitumi" and "Orthobitumi" with which and the Nernst-Gullstrand slit lamp, he obtains a magnification of 20–40 diameters.

Dr. Uribe Troncoso demonstrated the use of Koeppe's contact glass in normal eyes, in conjunction with the electric ophthalmoscope, by the direct method and a + 20 to + 40 diopters in the aperture. The electric ophthalmoscope marks a distinct advancement over the Salzmann method, and although the magnification is not so high as with the Bitumi, nevertheless it is sufficient for ordinary clinical purposes.

Gonioscopy the same as ophthalmoscopy, needs a special training first to obtain a clear image of the angle and then to interpret it; that is, to distinguish between the physiological condition and any pathological changes.

By means of pictures and diagrams, he described the normal appearance of the angle and the anatomic relations of its different structures, viz: the ciliary border of the iris, the ciliary body, its insertion to the sclera in different eyes, the zone of the Schlemm canal and the scleral zone adjoining the cornea.

As the author has pointed elsewhere he has never been able to see the Schlemm canal filled with blood; its contents appear to be a clear lymphatic fluid.

In pathological conditions, especially in glaucoma, gonioscopy is of great value and will find a place after the tonometric examination. In chronic simple glaucoma he has found the angle perfectly free, a fact completely at variance with the accepted views of the ætiology of this disease.

Dr. Homer E. Smith read a paper on **The Problem of the Immature Cataractous Lens.** A partially opaque lens, speaking generally, presents operative difficulties and attempts for its extraction are not justifiable in view of the immediate risks or the subsequent damage which may follow. Various procedures to mature the lens and so make it readily operable, have been practiced but have failed in their purpose and have fallen into merited oblivion. The choice of operation is between extraction in the capsule and the method the essayist advocates. At some length he goes into the mechanics of extraction in the capsule and contrasts the variants of the original procedure, expression following forcible rupture of the

zonula by external pressure, which was practiced by a Jamaican ophthalmologist 150 years ago. The five different methods are dealt with in detail and the difficulties and dangers compared with the simplified method, free from these, of his own operation.

His quotations from other writers are well taken in support of his contention that all which might be attained at great risk from the intracapsular operation may be equally secured with safety by another method. That there is no new technic to be mastered is urged as an advantage and even more, that it simplifies the present method of extraction with capsulotomy by making this step in the operation the easiest of all.

Having expressed the objections from the technical, surgical, and mechanical point of view to the intracapsular operation and how these should be the determining or deterrent factors for the occasional operator, he says, "I am prepared to admit, if all goes well nothing could be more beautiful or productive of such brilliant results, but that qualifying 'if' looms large to one who has witnessed many extractions in the capsule." Then is taken up in detail the objections to the capsulotomy operation and is shown how under improved technic these are in large part no longer tenable, and how the difficulties associated with this method may be overcome.

Following this phase of the subject he goes into the matter of extraction of the clear lens in high myopia, the technic for Morganian cataract, for mature cataract, and for such lenses as present much clear cortex. In these every step is elaborated and reasons given for the choice of methods.

A perfect operation is not the claim of the essayist and he sets forth the difficulties, dangers, and objections to his own method. Told in the fewest words this operation comprises: an ample crucial capsulotomy made with a special knife entered through the cornea, the pupil having been widely dilated, six hours before the extraction proper, which is then performed in the usual manner. It is the writer's contention that during the waiting period the aqueous insinuates itself between cortex and capsule and leaves the lens so loosely adherent that it is released at the lightest touch. Statistics are given of the results obtained by operators other than himself and which show a high percentage of successes. In his closing sentences he says,

"The method is safe and goes far to solve the problem of the immature cataract. It involves no departure from time-tried methods, nor is there a new and difficult technic to be mastered. It specially makes operable cataract in any stage of opacification and assures a clean and easy delivery of the lens."

DISCUSSION: DR. W. E. LAMBERT: Dr. Smith has said, his method of dealing with the immature cataract is in itself not new. I have frequently used it in connection with immature cataracts, where an extraction seemed advisable, and have even more extensively used it in the surgical treatment of high myopia.

I have found it a perfectly safe method, experiencing unpleasant complications in only three cases, all myopic cases, in two of which the complication was glaucoma which the extraction of the lens immediately relieved and the result was entirely satisfactory. The third complication was one not mentioned by Dr. Smith, the swelling of the lens and an extraction indicated, but the smear was found to be dirty and an operation would have been disastrous. Fortunately, the glaucoma was controlled by myotics and in a few days the smear was negative and the operation satisfactorily performed with perfect result.

I do not, by any means, advocate this method for general use, but only in such cases as it is indicated.

DR. H. H. TYSON: This subject is one which interests every ophthalmologist, both on account of the frequency with which he sees this condition and also his desire to adopt the procedure promising the best visual results with the greatest safety to the future integrity of his patients' eyes. In discussing this subject one can best give the opinion formed as a result of his personal experience, and the deductions from his observations of the operations of his confreres.

As to the intracapsular operation, I think that the results obtained at the Knapp Memorial Eye Hospital by the operators using that method give a better average result than indicated in the paper. While theoretically the damage supposed to be induced by the mechanics of the operation, as Dr. Homer Smith described, may occur, we know that in practice it happens quite infrequently.

We all have had cases where the patient performed involun-

tarily an intracapsular extraction upon himself by compression of his eyeball, and that very little reaction followed and with resulting good vision. Recently I saw such a case which has retained good vision for over seventeen years.

As to Dr. Homer Smith's method, of course imitators do not always possess the technique and finesse of the originators, and that accounts for the excellent results obtained by Dr. Smith and for some of the disappointments of others who have tried his method. Some years ago, in a discussion before this section, a number of operators stated that they had just as much difficulty in removing the cortex after extraction with Dr. Smith's method as in those cases performed without the preliminary capsulotomy. While I have been fortunate in obtaining good results in the few cases I have operated with the Homer Smith method, I also have had cases where the cortex appeared tenacious and resistant and failed to cloud rapidly after free crucial incision, and was difficult to evacuate completely. In my first case the lens was subluxated through faulty technique, as described by Dr. Smith, but a good result was obtained notwithstanding.

In the cataracts of feebleminded children, I have found a tendency toward the resistant tenacious variety, and would consider it as due to a biochemical condition of the individual. In considering any modification of the simple or combined method of extraction, has any been devised that gives better results than those obtained by the late Dr. Herman Knapp with an experience of thousands of cases? I think not!

While an operator should select the method applicable for each individual case, each has a preference for the majority of his cases, and mine is the combined extraction. While considerable depends upon the operator, just as much depends upon the patient and his condition. Heretofore little attention has been given to the patient's general condition previous to operation, and with the result in some cases that we have seen eyes lost which I am positive could have been preserved if the constitutional dyscrasia, sepsis, etc., had been treated and corrected previous to operation. I cannot urge too strongly the preparation of our cases for operation just as carefully and thoroughly as if for a major operation upon any other part of the body; then with asepsis and as little unnecessary trauma

as possible during the operation, a favorable result may be anticipated with any of the approved methods of operating.

DR. H. W. WOOTON has only done two operations by this method. If Dr. Smith means that all cataracts which show slight binocular changes should be extracted immediately he does not agree with him.

If the cataract is nuclear and the patient over 60 years the lens can be extracted by the ordinary method, without soft lens matter remaining. If the cataract is cortical it is better to wait until the lens is mature unless you are afraid some other man will operate on your patient.

He does not believe that this method should be used generally.

DR. FRIDENBERG said all operations have their vogue and the technic mentioned in the operation has been used for many years. He objects to doing the preliminary capsulotomy for the following reasons: We do not believe in multiplying operative proceedings; in preliminary iridectomy it is different for you can watch your patient until it is time to operate again. In this proceeding you must not operate too soon again to note reaction to your operation. He does not believe in making the incision through the clear cornea. It is better to operate sub-conjunctivally. He does not believe in hot bathing and taking tension after an intraocular operation. In the method by the use of the Kalt forceps a little traction may be used and if the zonule does not rupture easily proceed immediately to capsulotomy.

MEETING OF APRIL 18, 1921. DR. L. W. CRIGLER, CHAIRMAN.

DR. LEE M. FRANCIS of Buffalo, N. Y., read a paper on the **Surgical Treatment of Primary Epithelioma of the Cornea** (appears on page 331 of this issue).

DISCUSSION: DR. ARNOLD KNAPP believed Dr. Francis's method was excellent, as it was founded on sound surgical principles. There is, however, a group of corneal carcinomata, namely, the flat variety, often covering the greater part of the cornea, which offer difficulties to complete surgical removal, and in whom radium has given remarkable results. He asked if Dr. Francis used the actual cautery in his operation.

Dr. Charles H. May said there was a peculiar interest attached to the treatment of one of the patients he had seen with epithelioma of the cornea. In this instance the growth was extensive, flat, covered fully two thirds of the cornea and it would have been very difficult to remove by excision. Radium was tried but twelve exposures proved ineffectual. The patient disappeared but returned a year later apparently cured: the epithelioma had been treated with applications of pure carbolic acid by Dr. H. H. Beers and the growth had been removed leaving a less opaque cornea than had been observed previously.

Dr. Douglas Quick said he had treated three or four patients with primary epithelioma of the cornea. Two features make them favorable for treatment by radium; lesions are usually recognized early and the cornea stands radium very well. If radium is applied accurately, it is of value. The first case was treated six times by filtered radium. The lesions cleared up and remained so. The case was first treated in 1917. The second patient was treated this past summer. One dose apparently cured the patient. Recently an arrangement has been made to use unfiltered radium held in a bell and applied to the cocainized eye. One hundred and sixty-two millicuries were applied for two minutes over the center and one minute over each extremity. One dose almost cured this lesion. In another case, 177 millicuries were applied for one minute—the lesion cleared up. Improvement in technique and more accurate dosage has greatly improved and facilitated the results in the more recent cases.

Dr. E. S. Sherman said he wished to emphasize what the essayist had said concerning the resistance of the cornea to penetration by this type of growth. The practical importance of this fact is that it is not necessary, in excising the growth, to go very deep in the cornea. His attention was first called to this several years ago by a case of epithelioma of the cornea of a man 60 years of age, which began at the nasal margin of the cornea and at first resembled a small pterygium. On account of symptoms of irritation it was excised. It soon returned in the form of a small superficial ulcerated nodule and slowly increased in size until after 2 or 3 years it was 4 x 6 millimeters. It was then excised with a Graefe knife; the cut surface was

lightly touched with a galvano-cautery and covered with a conjunctival flap. This was early in 1917 and there has been no return of the growth.

Because the superficial character of these growths was not fully appreciated, the excision was carried deeper than necessary with the result that a few days after the operation there was a slight perforation of cornea. The distortion of the cornea from the excision caused 4 diopters of astigmatism. Doctor Sherman said that, while most of the growths of this character could be successfully treated by excision, in view of recent favorable experience that he had had with radium in epithelioma of the cornea, he would try that first.

Dr. Francis said, in closing, that he had not used the galvano-cautery in his cases. He saw no reason why carbolic acid should not be useful. He had also perforated the cornea in one of his cases, but the leak was not serious, nor did it impair the results.

Dr. E. C. Ellett, of Memphis, Tenn., read a paper on **The Corneal Suture in Cataract Extraction** (appears on page 341 of this issue).

Discussion: Dr. J. W. Cassell said he thought anything which adds to the safety of a cataract operation is worth while considering. He has used a modified Kalt suture in seventy-five cases and only had one prolapse of the iris. He believes it is valuable in that it allows one to get his patients up early.

Dr. E. S. Thomson said he did not believe a small amount of soft lens matter was very important except in delayed healing. He believes more in a conjunctival flap than he does in the suture. He does not use the corneal suture in the ordinary cases, but in dislocated lens cases he employs it. He thinks prompt healing in cataract extraction is very important. If vitreous is lost he believes that a suture is very convenient.

Dr. Lee M. Francis has operated upon fifty patients since he has seen Kalt's work. He believes the proper needle, needle holder, and thread are important factors. One of the most important disadvantages in his experience was the increased difficulty in making the incision because of cutting to a mark made by the sutures. Iris prolapse is not always prevented as evidenced in one case which developed vomiting, in which the suture tore out. He believes it is a valuable addition to the

technique of the cataract extraction, especially in the hands of a master like M. Kalt and an expert operator like Dr. Ellett. The technique, however, is not easy and should be undertaken only after experience on animals' eyes.

Dr. E. C. ELLETT in closing said that he finds that sometimes the suture can be passed without grasping the conjunctiva with fixation forceps but merely steadying the eye with a little pressure against it with the closed forceps. The discussion emphasizes the fact that it is difficult to standardize any operation.

Dr. Karl Lindner, of Vienna, read a paper on **New Truths Regarding the Bacteriology of the Conjunctiva.**

DR. LINDNER gave a résumé of the results of his investigations on the bacteriology of the conjunctiva. In studying the trachoma question, which has been his special work for many years, it was of course necessary to make a careful examination of the epithelial cells. In these studies there were brought to light so many interesting new facts that he determined to look more closely into the behavior of germs in general with regard to the conjunctival epithelial cells. He found that all germs causing infectious inflammations of the conjunctiva, attack directly the epithelial cells. For this reason he identified infectious inflammation of the conjunctiva as "epitheliosis." Here germs are parasites of the epithelial cells and are fastened to the epithelial layers. The number of bacteria present in the secretion, at least in the beginning of the disease, is very small when compared with the great number found growing on and in the epithelial layers.

Dr. Lindner explained how an infection begins, how it advances, and how it is cured by nature, without intervention. He illustrated these findings by exhibiting a great number of microphotograms, demonstrating the action of all bacteria causing inflammation of conjunctiva.

First, the infecting germ or germs localize at a place on the normal epithelial layer, which is closed. There they multiply forming regular pavements adhering to the surface of the epithelial layer. From this point the bacteria spread over ocular conjunctiva as a result of the normal movements of the eyelids, forming at other points new foci of infection. From the first groups of germs toxins are produced which enter into the

tissue by diffusion. This produces all the evidences of inflammation, such as enlargement of blood vessels, outgoing of blood serum and white blood cells. Inflammatory œdema is produced not only of the subepithelial tissue, but also of the epithelial layers. Thereby the connection between the epithelial cells becomes loosened. Furthermore the toxins produce a proliferation of the epithelial cells, which with the help of the œdema opens the layer which before this was closed and allows the germs to grow into the epithelial sheaths. The germs, however, remain fastened to the epithelial cells, where they continue to multiply. Considerable desquamation of epithelial cells goes along with the disease.

In infectious conjunctivitis the bacteria do not go into the subepithelial tissue, but confine themselves to the epithelium. The gonococcus, which is an exception, does that only rarely.

Other germs, such as Koch-Weeks, influenza-bacilli, and pneumococci, do not go deeply into the epithelial sheaths. This is especially true of the influenza-bacilli and pneumococci, which remain quite superficial. Dr. Lindner found also that all the germs referred to show a strong predilection for the bulbar conjunctiva, at least at the beginning of the disease.

The speaker then demonstrated the characteristic behavior of the various kinds of bacteria.

Diphtheria differs from all others in that the affected cells show marked signs of degeneration. Aside from this the diphtheria germ behaves as a typical epithelial parasite.

Trachoma may be classified with the bacterial infections, so far as the topography of the inclusions and free initial bodies are concerned, in fresh acute cases, because in this regard they are similar, in topography, to the infectious bacteria.

Following this, Dr. Lindner spoke about the natural process of healing, which he believed to be most clearly shown in gonorrheal conjunctivitis. Here the germs grow abundantly during the first few days, like large pavements, down to the subepithelial tissues, there being apparently nothing to stop this growth. At about the beginning of the second week, the germs are not to be seen in so great a number, nor do they extend any longer into the deeper layers of the now renewed epithelial layers. Careful examination shows often that quite a number of the more deeply situated gonococci are inside of

the epithelial cells, having been phagocytated by them. In the third week, the thickened epithelial layer is, as a rule, practically free of germs, except that a few small pavements are seen on the closed surface of the conjunctival epithelium. No bacteria, however, are to be found in the deeper layers. It is seen from this that the epithelial cells fight against the bacteria, pushing these back to the surface until they disappear altogether from the eye.

The phagocytosis by the polynuclear leukocytes plays no material part in the cure, because this phagocytosis takes place only in the secretion and practically never within the epithelial layer.

In Koch-Weeks conjunctivitis the phagocytosis by the epithelial cells begins early, the germs disappearing usually, except for a few, after four or five days have elapsed. In pneumococcal conjunctivitis the germs remain quite superficial always and disappear usually from the fifth to the seventh day.

Diplobacillar conjunctivitis is a typical and well-known conjunctivitis, but cannot be classified with the conjunctival inflammations before mentioned. The bacteria causing this are not parasites of the normal epithelium of the conjunctiva. In this disease, pavements are not found on the epithelium, except where the conjunctiva changes into skin. In other words, they are found only on the transitional epithelial cells and the moistened epidermal cells where the diplobacillus grows in great number forming typical pavements. Here we have the focus of the disease known as angular conjunctivitis.

The usual saprophytes of the conjunctiva, xerosis, staphylococci, and pneumococci (streptococci) do not grow on the normal epithelial cells. They are, however, to a greater or less degree, to be found in the secretion, and on dead epithelial cells, hence referred to as saprophytes. Xerosis, the typical saprophyte of the conjunctiva, is found most commonly on the wrinkled dead epithelial cells, forming these regular pavements. Staphylococci are found in the conjunctival sac only in very small numbers and rarely as pavement only on transitional cells. Pneumococci may form a pavement on dead pavement cells of the bulbar conjunctiva, and under this condition they are saprophytes.

Many other bacteria described as the probable cause of conjunctivitis are not to be found in the epithelial layer, nor on the epithelial cells, but only in the secretion and often only by cultures. The topography of bacteria is to be seen clinically. That is, the part of the conjunctiva having most germs is not inflamed. In gonorrheal disease, for instance, the bulbar conjunctiva is most affected in the early stages. In Koch-Weeks conjunctivitis and pneumococcal conjunctivitis the germs grow in greatest numbers on the epithelial layer of the bulbar conjunctiva, and in this way we account for the fact that this part of the conjunctiva is especially affected. In diplobacillar conjunctivitis the bacteria grow on the angle of lids, and accordingly we refer to this as angular conjunctivitis. From all this we must conclude that it is quite impossible for any germ to be the cause of a typical conjunctivitis when these germs are not to be found on and in the epithelial layer of the conjunctiva but only in the secretion.

Dr. Lindner invited attention to the peculiar fact that in the later stages of all infectious conjunctivitis even in quite untreated cases the number of germs is comparatively very small and appears to bear no relation to the continuation of the disease. For example, in gonorrheal conjunctivitis, in the later stage, germs are few; in Koch-Weeks conjunctivitis, after four or five days, germs are usually difficult to find but despite this the untreated disease may last from three to four weeks.

Dr. Lindner's explanation was to the effect, first, that the epithelial cells appear to be becoming immune against the attack of germs, otherwise the disease would not be cured without intervention, and the general organism takes no part in the disease and its healing; second, the immunity is not acquired at once and passes probably through a state of hypersensibility, which might explain the duration of the inflammation despite the small number of germs in the later stages of the disease.

DISCUSSION: DR. WILLIAM MEHL, of Buffalo, N. Y. I am convinced that Doctor Lindner's discoveries in the matter of conjunctival infections are of the greatest practical value to us all.

To my mind there are two points which stand out with

special force, and each of these points leads to important and practical deductions.

First: The doctor has demonstrated that saphrophytes of the conjunctiva thrive on dead epithelial cells which may happen to adhere to the normal layer, and that they are also found in the secretion of the eye, while on the other hand parasitic bacteria of the conjunctiva thrive on living conjunctival epithelial cells. By way of illustration he showed that the staphylococcus is a saphrophyte of the conjunctiva and not a parasite of that structure, and yet we all know that this germ causes intraocular infection. Since we have now been informed that the staphylococcus as well as various other germs are saphrophytes or benign germs of the conjunctiva, giving no warning of their presence, and that they may become parasites or malignant germs when they get into the interior of the eye, it is evident that we must make sure in every case that the bulbar and tarsal conjunctiva are cleansed thoroughly by mechanical means before we begin to operate. By this precaution we prevent, to a large extent, these germs from gaining entrance into the interior of eye during operation, and reduce danger from infection.

Second: The other point which has impressed me particularly has to do with the treatment of conjunctival infections. Until now the treatment considered most efficacious has been a local application of silver nitrate directly to the tarsal conjunctiva and cul-de-sac. Since we now know that the bacteria causing conjunctivitis are to be found not only on the tarsal conjunctiva and cul-de-sac, but also on the bulbar conjunctiva, it would seem that our method of treatment of these cases may be improved to a considerable extent. At any rate, we have been impressed with the need of according to the bulbar conjunctiva the same treatment as that given to the tarsal conjunctiva.

Dr. Martin Cohen asked Dr. Lindner if in his experience the microörganisms in mixed infection had been studied in reference to their localization on or in the conjunctiva; and whether smears from the tarsal conjunctiva were not sufficient.

Dr. Arnold Knapp asked how he obtained a smear of the epithelial cells?

Dr. Lindner in closing the discussion said that cell in-

clusion conjunctivitis is the only one of the purulent conjunctivitides which may be transferred to monkeys. Smears are made by cocainizing the conjunctiva and then scraping the epithelium away with the platinum spatula. Scrape only once. If you scrape twice you get blood which spoils the preparation.

DISCUSSION ON "DIABETES IN RELATION TO DISEASES OF THE EYE," AT THE ANNUAL MEETING OF THE OPHTHALMOLOGICAL SOCIETY OF THE UNITED KINGDOM, 1920.

By Mr. P. G. DOYNE, London, England.

Sir Archibald Garrod, K. C. M. G.: To the physician the ocular troubles of diabetes are less obvious than to the ophthalmic surgeon, and this is especially true of hospital cases with diabetes who seldom make any complaint of their sight. This is in part due to the fact that the majority of hospital patients are young and suffering the more acute forms of the disease whereas the ocular lesions are most common in elderly patients. To the physician the ocular manifestations are rather matters of scientific interest than of practical value, whereas to the ophthalmic surgeon the recognition that symptoms are of a diabetic origin is of the utmost importance. Various estimates may be found of the frequency of ocular lesions in diabetes, but to be of any value they should be based on observations extending over a great many years.

Diabetic retinitis is of special interest. Here is a condition which presents an ophthalmoscopic picture sufficiently similar to that of albuminuric retinitis as to need an expert to differentiate. Diabetic retinitis is seen only in the elderly whereas albuminuric retinitis is met with at every age. In many cases of diabetes with retinitis and no albumin in the urine, post-mortem examination revealed morbid changes in the kidney. Again albuminuria in diabetes does not of necessity point to serious renal trouble, and patients with granular kidney may show no albumin in a 24 hours' specimen of the urine. These observations all tend to show that the occurrence of retinitis in diabetes is not necessarily to be attributed to the

accumulation of sugar in the blood nor of the accompanying acetone bodies. More probably cardiovascular changes are an important factor and it will be found that diabetic retinitis is associated with increase of blood pressure. Speaking from his own records Garrod in most cases found evidences of renal disease in patients who developed diabetic retinitis. Probably hyperglycæmia, the most prominent feature in diabetes, is not even the most important factor in the production of retinitis. If it was so, retinitis would be seen in young diabetics. It is significant that cardiovascular changes and high blood pressure are present in nephritis cases, young and old, but are present only in diabetics over middle age.

Diabetes is no single disease but merely denotes the excretion of sugar in the urine over long periods. In some cases with continuous glycosuria the blood sugar is not in excess and may even be diminished, and there are cases of diabetes innocens where large amounts of sugar are excreted apparently without detriment and uninfluenced by diet. For the most part these occur in young subjects.

There is the acute diabetic of early life who dies in a few months and the mild diabetic of middle age who lives on for years and in whom sugar appears in the urine only after carbohydrate indiscretions. These latter cases, however, most frequently show the retinitis. There is the class of diabetics in which disease of the pancreas is responsible for the glycosuria and the cases where the origin of the disease is in the endocrine glands. It seems reasonable to adopt as a working hypothesis the idea that the vascular changes and the high blood pressure are the leading factors in the production of both diabetic and albuminuric retinitis but that a second metabolic factor is necessary for the production of the retinitis—in the one instance the accumulation of sugar in the blood and in the other the retention of urinary excretory products.

Regarding prognosis, diabetic retinitis has not so grave a significance as albuminuric retinitis.

After mentioning, as complications of the disease, the tendency to sepsis, iritis, lipæmia retinalis, lowered tension, retrobulbar neuritis, and the loss of the power of accommodation, Garrod, referring to cataract, states that the view that the withdrawal of water from the lens by reason of the presence of

sugar in the aqueous humor, is no longer tenable as the amount of sugar present is insufficient and sugar itself has been shown to be present in the lens itself. The cataract, developing rapidly in young persons, must be the direct outcome of the disordered metabolism.

Regarding treatment, the great value of fasting is now amply proved. The method used at St. Bartholomew's Hospital is as follows:—2–3 vegetable-egg days are given, followed by 1–2 fasting days, then again 1–2 vegetable-egg days and so on. A rising scale of diet is then ordered until the limit of the patient's carbohydrate tolerance is reached. The treatment is repeated at intervals. The alimentary rest restores the tolerance to carbohydrates and gets rid of the hyperglycæmia and acetonæmia.

Mr. Foster Moore: The most important ocular manifestations of diabetes are:

1. Retinitis.
2. Cataract.
3. Retrobulbar neuritis.
4. Retinal and vitreous hemorrhages.
5. Lipæmia retinitis.

and of lesser importance:

6. Alterations in the ocular tension.
7. Alterations in the refraction.
8. Iritis.
9. Debility of accommodation.

1. Retinitis. While admitting the strong likeness between diabetic, renal, and arteriosclerotic retinitis, the following are the distinctive features of the diabetic form: (a) The patches of retinal exudate tend to have sharp-cut edges, are often solid and soapy looking, are frequently distributed in an uneven manner or tend to form an irregular ring wide of the macula. (b) The star-shaped figure is seldom seen. (c) The soft edged cotton wool patches, common in renal cases, do not develop. (d) Retinal hemorrhages tend to be in the deeper layers and so are roughly circular in outline and are usually well wide of the central regions. (e) Circular retinal pigment spots, seen in the late stages of renal retinitis, are not seen.

In addition diabetic retinitis does not occur in the young.

Judging from experience at a general hospital, the retinitis

occurs in about 10 per cent of the cases of retinitis. The prognosis is less grave than in the retinitis of renal or arteriosclerotic cases.

Cataract. Foster Moore thinks that the term "diabetic cataract" should be confined to the rapidly developing opacity of the lens which occurs in young diabetics. This opacity is bilateral, of a diffuse homogeneous type and tends to start in the posterior layers. In older patients it is not possible to dissociate the senile element, though it would appear that the frequency of cataract in elderly persons (diabetics) is greater than in normal persons of the same age. As regards operation in these cases of elderly diabetics, though the healing after lens extraction is not quite so smooth or free from complications yet the majority of cases do well.

Retrobulbar Neuritis. This condition is probably not rare during the course of the disease and occurs usually in the middle aged cases. The onset is sudden and recovery is the rule, though if prolonged some permanent atrophy may result. Its development does not indicate an increase in the gravity of the prognosis. It is often difficult to dissociate the complication of tobacco and alcohol, the toxins of which superimposed upon the already sensitive nerve may be the real causative agent.

Lipæmia Retinalis. It is probable that only in diabetes does the condition attain a sufficiently high degree to give rise to the characteristic appearance. It is stated that the fat content of the blood must reach about 5 per cent before lipæmia retinalis occurs. In one case, seen by the speaker, the first sign was a milky appearance of the vessels, their color remaining unaltered. Slowly the milkiness became more pronounced and the color became more cherry red, the arteries and veins gradually approximated each other in color until the appearance was characteristic. It is seldom seen in any but young subjects and is of very bad prognostic purport.

Alterations in Refraction. This has been frequently noticed. The alteration is usually an increase towards myopia and alterations have been as much as 7D. A rapid return to the normal occurs with decrease in the sugar output.

Iritis. The clinical evidences of iritis are seldom seen; this is somewhat remarkable as histological examination of the eyes of

diabetics almost always shows swelling and proliferation of the pigment epithelium of the iris. In one case seen by the speaker an acute primary iritis developed in a diabetic patient and no other discoverable cause was present. A gelatinous exudate rapidly formed in the A. C. similar to an acute gonorrheal iritis.

Dr. Leyton pointed out that the presence of sugar in the urine, though the simplest way of recognizing the disease, yet was one of the least important alterations in the metabolism. In diabetes mellitus the excretion of metabolites was impaired. By the use of phenolsulphonphthalein, a material easily recognized in the urine and excreted by most people at a uniform rate, he had found that the excretory powers of the kidneys in diabetes mellitus were impaired.

Regarding blood pressure and the vascular changes resulting from it, he pointed that different areas of the body were affected in different ways and this would account for possible changes in the retinal vessels with a general systemic blood pressure unaltered. He emphasized the ease with which other toxic stimuli—vaccines, tobacco, etc.,—would have a deleterious effect on the metabolism of a diabetic.

Dr. G. Mackay said that the rapidly developing cataract in young diabetics was the most common ocular phenomenon. It was usually diffuse and bilateral. He did not usually experience any greater difficulty in the surgical treatment of cataract occurring in diabetics, but one must bear in mind in these cases that their immunity to infection is generally lowered. He places retinitis as the second most frequent phenomenon.

Dr. F. J. Poynton said that from the examination of statistics he was forced to the conclusion that there was no such thing as a diabetic cataract but only cataract in the diabetic, the result of a presenile change; but in his opinion cataract was more common in diabetics than in sufferers from renal disease or cancer, in both of which conditions one would associate presenile change. Regarding ocular paralyses he would mention three cases; one, a recurrent paralyses of the 6th nerve, coinciding with an exacerbation of the glycosuria; the second, of abrupt onset, occurring to a cricket referee while actually on duty; the third, an ophthalmoplegia associated with severe bulbar symptoms.

Mr. P. H. Adams said in his experience diabetic retinitis was more common in females than males. In his statistics all the cases occurred between the ages of 50 and 70, and after the discovery of the retinitis 8 years was the longest period of life. He often saw patients with typical diabetic retinitis who were sugar free but who were found to have been treated for glycosuria, with success, some years previously. He mentioned a case of diabetic retinitis with lowered tolerance to tobacco. With reference to the lens changes, the appearance of numerous vacuoles is of the greatest significance.

Dr. Cammidge: He had reviewed the statistics of 350 of his cases and found that the age incidence of the various complications agreed with those of the previous speakers. Glycosuria is not a disease. It might occur in a variety of conditions. There was the condition in which sugar was present in the urine of young people persisting often indefinitely and little affected by diet. These people went on for years perfectly well. In them the blood sugar was below the normal. In the cases of diabetes in which there was a hyperglycæmia, there was the pancreatic type and the hepatic type and other types. The chemistry of these cases was not identical. For instance in the pancreatic type the blood did not easily coagulate whereas in the hepatic type it did. This might have a bearing upon hemorrhages in the retina. The question of the relative amounts of tyrosin and cholesterin found in certain forms of cataract was of interest. In the hepatic type there was an increased formation of amino acids, of which tyrosin was one. It was probable that diabetic cataract was partly dependent upon changes in the amino acid content of the blood. The changes in vision, occurring in people after they had got rid of their sugar, might be due to changes in the water content of the tissues of the eye. He had noticed many cases of diabetes develop œdema of feet and abdomen as the sugar and acidosis decreased.

Mr. Gray Clegg reviewed the cases of extraction of cataract in patients with glycosuria at the Manchester Royal Eye Hospital during the last 20 years. The final results were not remarkably below the average for all cataract extractions. A noticeable complication was the frequency of hemorrhage into the A. C. and hyphæma.

Dr. Hawthorne from his experience of cases of glycosuria said that retinitis was only an occasional event when glycosuria was abundant and it may occur with merely slight glycosuria. It seemed doubtful whether the glycosuria was responsible for it. With regard to the ocular palsies associated with glycosuria, the same might be said.

Mr. R. R. James recorded the results of 5 cases of cataract in young diabetics operated upon at St. George's Hospital during the last 11 years. In 4 of the cases the results were satisfactory and in one case the eye had to be excised. He advised preliminary medical treatment until a marked fall in the sugar output had taken place and then extraction without iridectomy. He did not advise lavage.

Mr. Bardsley mentioned two cases of diabetic retinitis in youngish persons, the age of one being 26 and the other 35. In both cases the retinitis had improved marvelously under a mixed Allen-Graham treatment. He did not think that it was possible by means of the ophthalmoscope to differentiate between albuminuric and diabetic retinitis. He objected to classifying those cases of retinitis without albuminuria or glycosuria as arteriosclerotic cases; the arteriosclerotic case formed a group by itself. Many of these cases of retinitis were due to varying toxæmias. In his opinion glycosuric retinitis was not necessarily accompanied by high blood pressure.

The case, aged 25, which he had mentioned, had a blood pressure of 120 and there was a large quantity of sugar in the urine and intense acetonuria. He had never seen a diabetic retinitis without acetonuria.

Mr. Stack spoke of the danger of coma occurring in diabetic patients on admittance to hospital. It was probably due to the change in the surroundings and diet. He thought it a wise precaution to make the change in the diet gradually.

Mr. Harrison Butler mentioned a special type of a diabetic retinitis of which he had seen two cases lately. It consisted in a dark area of pigmentation around the macula. He was strongly in favor of operating on cases of cataract in young diabetics. The gain to the patient, even with regard to the short period of life remaining, should be afforded him.

Mr. Burdon Cooper said that he had found on examining cataractous lenses removed from diabetic patients who also

had sugar in the urine, that cholestorin was present in excess of the amino acid tyrosin. He had so far not tested the lens for glycogen. He thought that the dehydration theory of cataract should now be discarded; the pendulum was swinging the other way towards hydrolysis as the cause. He had estimated the sugar in the aqueous in one case of diabetes and found it to be 0.45 per cent; he did not think that that amount of sugar in the aqueous, of itself, could produce cataract. His own work confirmed the view that the acids and ferments which were secreted by the ciliary body into the aqueous were responsible for the hydrolytic changes in the lens. He mentioned an interesting case in his own practice of a child with lamellar cataracts upon whose lens 4 needlings produced no opacity. He concluded that in this case the aqueous was devoid of an hydrolytic ferment. He therefore fed the patient on root vegetables and in a few weeks was able to needle the lens satisfactorily. He regarded cataract as a decomposition taking place in the lens and regarded the term "senile cataract" as a misnomer as senility per se had little or nothing to do with the change.

REPORT OF THE TRANSACTIONS OF THE OPHTHALMOLOGICAL SECTION OF THE ROYAL SOCIETY OF MEDICINE.

By Mr. H. DICKINSON, London, England.

The Sections of Neurology and Ophthalmology held a two-evening debate on the subject of **ocular palsies** on the 10th and 11th of March, the chair on Thursday being occupied by Professor Reynolds, and on Friday by Dr. James Taylor.

Discussion on Ocular Palsies.

Dr. Gordon Holmes, who opened the debate, devoted a good deal of attention to the question of the situation and nature of the lesion in various forms of paralysis or paresis of oculomotor nerves, and he had much to say about associated palsies. A matter of much interest was the "unwillingness" or reluctance of some patients with cerebellar disease to turn the eyes towards the side of the lesion in performing conjugate deviation. Since he had been attached to the staff of Moorfields Eye Hospital he had seen many cases of ocular palsy, and in each of them he was conscious of a difficulty in deciding what the case was likely to be due to. Only by a careful weighing of the signs of associated disease could even a presumptive diagnosis be arrived at. With regard to such palsies occurring in association with Graves' disease, it was interesting and surprising that not very many years ago Hughlings Jackson and others regarded such palsies in this connection as very exceptional. Dr. Holmes, however, now saw a considerable number of cases in which the association existed. One had to regret, however, a paucity of histological work in this relation. With regard to so-called rheumatic or toxic neuritis of oculo-

motor nerves, he had seen a number of these cases, and there was a frequent involvement of the external rectus, or of the muscles innervated by the third nerve, associated with pain in the forehead on the same side; sometimes there was considerable anæsthesia. In some of the cases he had seen there was a septic focus in the neighborhood. In these cases Déjerine and others had found merely degenerative changes in some part of the nerve. He did not find it easy to conceive of cold affecting ocular nerves in their intracranial course. He did not feel that these cases were rheumatic, nor purely toxic, because most toxic affections were bilateral, or at least more or less symmetrical; whereas most of these palsies were unilateral. In the spinal cord, local collections of cerebrospinal fluid formed and compressed the roots of the nerves, or the cord itself, and he thought loculated collections of cerebrospinal fluid might form in the base of the brain and involve one of the oculomotor nerves.

Mr. Leslie Paton spoke of the complexity of the subject. For example, one disease alone—syphilis—was capable of producing an oculomotor paralysis in many different ways. It might affect any part of the oculomotor apparatus: cortical, supranuclear, nuclear, nerve roots, nerve trunks in their intracranial course, in the cavernous sinus, or in the orbit; or it might implicate the muscles themselves. A gumma might develop at any point. A syphilitic meningitis might affect the nerves. Syphilis, setting up disease of vessels, might cause hemorrhages affecting the nuclei or nerve roots. Or a syphilitic arteritis in the internal carotid might press on nerve trunks in the wall of the cavernous sinus, or an endarteritis might affect the vessels supplying the crura, the mid-brain, or the pons, and cause areas of softening. Or syphilis might cause general paralysis or tabes and hence the variety of ocular disturbances found in them. Yet probably not more than 40% of cases of ophthalmoplegia were due to syphilis.

Oculomotor paralyses might be divided into three main groups, of which there were subgroups.

I. Paralyses of central or cerebral origin, comprising: (a) supranuclear lesions; (b) internuclear lesions; (c) nuclear and nerve root lesions.

II. Paralyses of extracerebral origin, *i.e.*, of nerve trunks,

again comprising, as subgroups, (a) intracranial; (b) intra-orbital.

III. Paralyses of muscular origin.

The arrangement and relations of the oculomotor nuclei was, he said, the subject of much discussion, and no dogmatic opinion was possible at the present stage of knowledge. The important internucleal set of fibers was, undoubtedly, the posterior longitudinal bundle, for it was by means of this that the various oculomotor nuclei were brought into connection with one another and with the vestibular and auditory functions, and with the general muscular, the sense and the other afferent impulses in the body.

The connections of the posterior longitudinal bundle are, he said, intricate, and had not been yet completely worked out. The most important nucleus of origin of these fibers lay in Dieter's nucleus. The control of the internal musculature of the eye was also a matter of considerable doubt and dispute. The vascular supply of the oculomotor nuclei was derived from the anterior end of the basilar artery. The vascular lesions affecting the pons, crura, and this region gave rise to various interesting forms of crossed hemiplegia, the most important being known as "Weber's syndrome," "Benedict's syndrome," "Foville's syndrome," and the "Millard-Gubler syndrome."

Nuclear ophthalmoplegias, or ophthalmoplegias proper, could be subdivided into acute and chronic types. The acute included the toxic form caused by alcohol, Wernicke's acute polioencephalitis superior hemorrhagica being a good example. Good examples of the infective type were found in lethargic encephalitis, influenza, and syphilis. In a very definite proportion of cases of acute ophthalmoplegia, however, no infective agent can be traced. Of chronic progressive ophthalmoplegia, the most important form was that occurring in tabes and general paralysis of the insane. There were, besides, certain ophthalmoplegias of congenital origin, and others were of a distinct familial type.

Dr. Wilfred Harris thought cases of chronic nervous disease in which weakness of one internal rectus was noted on attempts at conjugate deviation, were not rare. He had seen a number. One was in the subject of disseminated sclerosis,

who could not look upwards, though other eye movements were intact; he had no nystagmus. Such cases were probably due to interruption of the fibers of the posterior longitudinal bundle. He spoke of cases of damage to the 6th nerve following injection of the Gasserian ganglion with alcohol. The patient was a difficult subject, in whom three attempts had to be made, and then suddenly a greater quantity of alcohol than was intended entered the locality. Recovery from the result of this accident always occurred in a few months. He asked whether his colleagues recognized a rheumatic neuritis of oculomotor nerves, branches of the 3d or the 6th in the orbit. It had not been rare for him to see palsy in the external rectus with some pain in the orbit, and there might be some anæsthesia. He did not think the teeth were at fault in all the cases, nor was a definite septic focus evident.

Dr. J. Gray Clegg (Manchester) devoted attention to the occurrence of ophthalmoplegia in Graves' disease. Osler and McCree regarded such occurrence in this disease as a complication, rather than as part of the main disease, but in his *Pathology of the Eye* Parsons said extrinsic ocular paralyses in this association were not uncommon. J. S. Bristowe had recorded a case in which ophthalmoplegia externa followed Graves' disease after an interval of three years, and in that case no disease of the nervous system was found post mortem. This and similar cases Hughlings Jackson regarded as remarkable. According to G. F. Suker (*Journal of the American Medical Association*, 1917) a new ocular muscle symptom was present in quite a number of cases of Graves' disease, which that observer designated as a deficient complementary fixation in lateral rotation. It was considered by him to be due to the same underlying conditions as those which produced the other ocular muscle symptoms, *i.e.*, dissociation in the functions of the sympathetic and extra-ocular motor nerves of the eye. But it was rare for practically complete bilateral double ophthalmoplegia to occur in this association. Dr. Gray Clegg recorded in detail one such case in this contribution. Considerable recovery of ocular muscle power took place during the patient's convalescence from the general disease.

Dr. S. A. Kinnear Wilson limited his remarks to the question of the possible occurrence of unilateral cranial polyneu-

ritis. He related the case of a man who had been in Palestine and Egypt, and in Cairo was very ill with pneumonia and pleurisy, and seemed to have a generalized pneumococcal infection. While his illness was at its height he developed complete paralysis of the 7th, 8th, 9th, 10th, 11th, and 12th cranial nerves, but only on the right side. Ordinary tests for nervous disease and syphilis tests proved negative. He had a girl under care who certainly had a rheumatic diathesis, and she had paralysis of the 5th, 6th, and 7th nerves on one side only. A case was on record of an Italian engine driver who always stood on the right side of his engine, and had the wind and rain on that side of his face; he developed paralysis of the 3d, 4th, 5th, 6th, 8th, and 12th on the right side only.

Mr. N. Bishop Harman commented on the comparative rarity of cases such as were under discussion. He said that in a consecutive series of 5,000 patients he had found only 27 instances of ocular palsy. Males were more often affected than were females (males 17, females 10). Paresis due to injury headed the list of causes, with 7; syphilis caused 5, and general vascular disease or degeneration 5. Two cases due to exposure were arguable; but in one of them there were very definite manifestations of inflammation over the affected muscle, and both cases were rapidly cured. His cases did not warrant the view that life was shortened by the occurrence of these paralyses. With regard to treatment, he said he knew of no more satisfactory way of overcoming the diplopia than the wearing of spectacles of which one lens was of ground glass. And of local measures of treatment, blistering, massage, and faradism were effective when the lesion was peripheral.

Mr. Hines read a joint paper by himself and Mr. MacMullen on **chronic progressive ophthalmoplegia externa.** They said that in their text-book on *Neurology of the Eye* Wilbrand and Saenger grouped as a clinical entity certain cases of external ophthalmoplegia which they considered to have certain definite characteristics which separated them off from the congenital cases, as well as from those due to a definite toxic cause, or to syphilis, or associated with some manifestations of widespread disease of the nervous system. These cases Wilbrand and Saenger stated to have the following characteristics: 1. Onset gradual, usually in infancy or early life.

2. The ophthalmoplegia is bilateral and very slowly progressive. 3. There are no other signs of disorder of the nervous system, nor any affection of the general health. 4. The disease may come to a standstill, either permanently or for long periods, at any stage in its development, but generally ends in complete, or nearly complete external ophthalmoplegia. Mr. MacMullen and Mr. Hinds showed to the Section two patients whose condition tallied with this description, and they had seen a third.

Mr. M. S. Mayou sent a short communication on two cases of paresis of the upward and downward movements of the eyes. A man aged 46, while straining at stool, was seized with severe pain in the head, and giddiness. Afterwards he could scarcely walk owing to the diplopia and inability to look in a downward direction. The pupils were active to light. Convergence and lateral movements were normal. The vision was $\frac{6}{12}$ in each eye, there was no optic neuritis, and the knee jerks were present. Wassermann reaction was negative. After rest, and the administration of iodide of potassium, the patient obtained full movement in the downward direction, but there remained some limitation of the movement of the eyes upward, and the attempt brought on a coarse nystagmus. Recovery was now practically complete. The second case was also a male, and his age was 42. He was suddenly seized with intense vertigo and diplopia, but no headache. The pupils were very sluggish; vision $\frac{6}{9}$ in either eye. Outward and inward movements were free, but all power of convergence was abolished. Knee jerks were present, Wassermann test negative. He was put on iodide of potassium, and gradually recovered. The sudden onset suggested hemorrhage as a cause. Mr. Mayou said that the position of the lesion had been variously stated to be the optic thalamus, the corpora quadrigemina, the pons, and some thought it was subcortical. None of those conjectures had been verified by post-mortem examination.

Mr. J. H. Fisher, referring to the cases in which the 6th nerve was accidentally damaged when injecting alcohol into the Gasserian ganglion, said he thought the damage did not occur actually in the floor of the cavernous sinus, but that the alcohol had stripped up the dura mater and involved the 6th nerve behind the sinus.

Dr. James Taylor expressed regret that myasthenia gravis had not loomed fairly large in the debate, as that was one of the common grounds on which the neurologist and the ophthalmologist met. Since he had been associated with Moorfields Eye Hospital he had seen many such cases, and he had been impressed by the great variability in their course, though in many the progress was definitely downwards. On one day the patient would have almost complete command of ocular movements, and at another time he could scarcely carry out any ocular movements, nor effectively use his arm and hand muscles. He described one remarkable case which was in an advanced condition, in which the patient suddenly developed an intense desire to return to his home—some 80 miles distant—where he went, and was not heard of again until he wrote asking for a certificate that he had been a sufferer from myasthenia, as he had been warned for military service! He was at the time following his occupation of carpenter.

Dr. Gordon Holmes and Mr. Paton replied.

REPORT ON THE PROGRESS OF OPHTHALMOLOGY.

Abstracts by Drs. A. N. ALLING, New Haven; M. J. SCHOENBERG, New York; T. H. BUTLER, London; P. J. DOYNE, London; and K. WESSELY (*Archiv für Augenheilkunde*), Wurzburg.

Edited by MATTHIAS LANCKTON FOSTER, M. D., F. A. C. S., New Rochelle, N. Y.

(*Continued from May number.*)

VII.—THE LIDS AND LACRIMAL ORGANS.

59. BEDELL, A. J. **Multiple vaccination of the lids.** *American Jour. of Ophthalmology*, February, 1920.

60. GALLEMAERTS. **Palpebral fistual of the accessory lacrimal gland.** *Annales d'oculistique*, clvi., 3.

61. HOWARD, C. N. **Carcinoma of the orbit originating in the lacrimal gland.** *American Journal of Ophthalmology*, May, 1920.

62. KUBIK. **Cysts of the lacrimal sac.** *Klin. Monatsbl. f. Augenheilk.*, lxiv., p. 264.

63. NAGEL, C. S. **Fungus concretion in the lacrimal canaliculus (streptothricosis, actinomycosis).** *American Journal of Ophthalmology*, May, 1920.

64. PATERSON, J. V. and FRASER, J. S. **Intranasal dacryocystostomy.** *British Journal of Ophthalmology*, May, 1919.

65. SCHILLER. **Sarcoma of the eyelid.** *Zeitschr. f. Augenheilk.*, lii., p. 302.

66. VON SZILY. **Pathology of the lacrimal passage in the roentgenogram.** *Klin. Monatsbl. f. Augenheilk.*, lxiv., p. 31.

67. WEIS. **New operation on the lacrimal sac from the nose.** *Med. Klinik*, xvi., p. 138.

68. WELLS, D. W. **An infected granuloma of the lacrimal gland.** *American Journal of Ophthalmology*, August, 1919.

69. WHEELER, J. H. **Free dermic grafts for the correction of cicatricial ectropion.** *Ibid.*, April, 1920.

BEDELL (59, **Multiple vaccination of the eyelids**) reports the case of a woman who had dressed a vaccination wound and

developed three days later a severe ulceration of the right lower lid, which spread to the cornea and went on to perforation. An extensive symblepharon resulted which necessitated a transplantation operation. There was also a less marked ulceration of the left lower lid. ALLING.

SCHILLER (65, **Sarcoma of the eyelid**) describes a case of melanosarcoma of the conjunctiva of the lower lid. A black elevation with a slightly granular surface ran from the middle of the margin of the lower lid to the lower transition fold. Microscopical examination showed: The conjunctival epithelium was normal, broken only in one place by fine, fibrillary connective tissue with few nuclei. Beneath the epithelium were irregular masses of lymphoid cells forming confused strings. The connective tissue was very sparse in the middle of the tumor, abundant in the periphery in thick cords. Much dark brown pigment was demonstrable in the tumor partly as granules in the tumor cells, partly free in masses, especially in the connective tissue. Schiller gives a review of the published cases of sarcoma of the lid, from which he finds that both sexes are affected about equally often. Leucosarcoma appears at all periods of life, the pigmented form after the third decade. The frequent involvement of the lower lid is noteworthy. Both forms usually originate in the conjunctiva tarsi and in the transition fold. Comparatively often sarcomata start in pigmented nævi, and follow traumatism. Pigmentation of the conjunctiva is often seen in the neighborhood of the neoplasm. The prognosis as to recurrence is unfavorable, particularly in children. The interval before recurrence is quite uncertain. The tumors very rarely penetrate the globe, but frequently involve the orbit. Treatment is thorough, early removal.

WHEELER (69, **Free dermic grafts for the correction of cicatricial ectropion**) does not approve of pedicle flaps in these cases but prefers a free flap from the lid or temple. After opening a wound in the lid and cutting out all cicatricial tissue he denudes three small areas at the edge of each lid and sutures them together so that they adhere thus keeping the wound apart. A flap is then sutured into the wound and firm pressure applied. If the ectropion is of the lower lid and a graft taken from the upper, the results are most gratifying.

ALLING.

NAGEL (63, **Fungus concretion in the lacrimal canaliculus**) operated upon a tumor about the size of a small bean situated over the lower canaliculus and found a dark green mass which was removed in toto. It proved to be a case of streptothrix.

ALLING.

According to PATERSON and FRASER (64, **Intranasal dacryocystostomy**) it seems probable that some modification of West's operation will become stereotyped as the classical treatment of those cases of dacryocystitis which do not yield to a course of lavage. Treatment by probing was condemned by Percival Pott and is now universally discredited as unsurgical and disappointing in its effect. Probably every ophthalmic surgeon has seen eyes lost from a serpent ulcer of the cornea caused by infection from a dacryocystitis "cured" by probing. Paterson, an ophthalmic surgeon, and Fraser, a rhinologist, both of Edinburgh, have operated upon a series of cases by a modification of West's operation which they fully describe with the help of some useful diagrams. Of 50 cases operated upon, 48 reported, 24 in person, 24 by letter. Of the former 19 were completely cured, 2 had slight epiphora, and 3 were failures. Of the latter 19 wrote that they were cured, 1 stated that she had slight watering of the eye, and 3 were as bad as they were before the intervention.

The reviewer for the past two years has referred most of his cases to a competent rhinologist who has performed a West's operation. The results have not been tabulated but have been most gratifying. The important factor in the case is to choose a rhinologist who will take an interest in the work and master the necessary technique. Every ophthalmic hospital should number a rhinologist upon its staff. So far in England the only hospital that has taken this step is the Birmingham Eye Hospital which has recently appointed Mr. F. W. Sydenham as Honorary Rhinologist. T. HARRISON BUTLER.

WEIS (67, **New operation on the lacrimal sac**) has modified West's operation somewhat. Under local anæsthesia he incises the nasal mucous membrane, shoves back the periosteum from the outer side of the frontal process of the superior maxilla, chisels out a bony flap about ½*cm* broad, and removes this with the mucous membrane. He then removes the greater part of the lacrimal sac with sharp forceps under the guidance

of a finger placed on the outer surface. He says that the operation gives a good result.

KUBIK (62, **Cysts of the lacrimal sac**) describes a case met with in a woman 21 years old, who had epiphora, but whose lacrimal sac readily washed through. In the region of the lacrimal sac there was an elastic swelling which extended upward to the palpebral ligament, downward into the lacrimonasal duct where its limits could not be made out. No regurgitation on pressure. Toti's operation was performed, and the swelling was found to be caused by a cyst filled with serous fluid which did not connect with the lacrimal sac, but was attached to its posterior wall.

VON SZILY (66, **Pathology of the lacrimal passage in the roentgenogram**) reports two cases in which the only apparent fault in the lacrimal sac was a secretion of pus. As syringing of the sac met with no obstacle, there appeared to be no stenosis and no change in the canal. But the X-rays showed in both cases a fistula between the lacrimal sac and the nose which could be recognized in no other way. Such a fistula may be caused by an empyema or tuberculosis of the ethmoid cells, or by a primary disease of the lacrimal sac, and, under certain circumstances, it might bring about a spontaneous healing of a dacryocystitis.

GALLEMAERTS (60, **Palpebral fistula of the accessory lacrimal gland**) describes a case of this nature.

HOWARD (61, **Carcinoma originating in the lacrimal gland**) removed a small tumor of the lacrimal gland but it recurred in four months. He then did an exenteration of the orbit cauterizing the entire orbit. After four years there was no return of the growth.

ALLING.

WELLS (68, **An infected granuloma of the lacrimal gland**) removed a tumor of the lacrimal gland, the major part of which consisted of a fibrous stroma supporting collections of irregular branching tubular glands and of tissue made up of fibrous elements, vessels, and large numbers of lymphocytes. There were also collections of so-called epithelioid cells. Although the Wassermann test was negative and also the skin test for tuberculosis the diagnosis seemed to lie between syphilis and tuberculosis. ALLING.

VIII.—THE ORBITS AND ACCESSORY SINUSES.

70. BLAIR, V. P. **Report of two cases of Kroenlein's operation.** *American Journal of Ophthalmology*, November, 1920.

71. BLAKE, E. M. **Orbital, epidural and brain abscess. Autopsy and microscopic studies.** *Ibid.*, December, 1920.

72. CHARLIN, CARLOS. **Orbito-cranial syphilis.** *Annales d'oculistique*, clvi., 4.

73. DIMITRY, T. J. **An operation relegating enucleation of the eye to its proper position.** *American Journal of Ophthalmology*, September, 1919.

74. OERTEL, T. E. **Spontaneous luxation of the eyeball.** *Ibid.*, November, 1920.

75. STENGER. **Relations of eye diseases to diseases of the nose and accessory sinuses.** *Med. Klinik*, xvi., p. 221.

76. VAN DUYSE and AUBINEAU. **Epithelioma of the orbit.** *Archives d'ophtalmologie*, xxxvi., 7.

BLAIR'S (70, **Kroenlein's operation**) first case was a tumor of 2*cm* across which was attached to the posterior surface of the globe and extended backward into the orbit. It was composed of fibular tissue and of cells resembling glio cells as well as of fibroblasts. It was vascular and contained nerve fibers. The other case was one in which the blade of a pocket knife had broken off in the orbit and had been retained for a number of years. At operation the blade was found in the orbit with the point extending into the middle fossa of the brain. It was easily removed and the patient made a good recovery.

ALLING.

BLAKE (71, **Orbital, epidural, and brain abscess**) reports a case of infection of the orbit from a purulent frontal and ethmoid sinusitis. The patient died from purulent meningitis and brain abscess. Such cases show the importance of immediate drainage of the nasal sinuses in beginning orbital involvement.

ALLING.

OERTEL (74, **Spontaneous luxation of the eyeball**) relates the case of a negro woman, 25 years of age, whose left eye could be luxated between the lids by retracting them. At times the eye protruded through the lids spontaneously especially when stooping. The vision was normal and the ophthalmoscopic examination negative. ALLING.

CHARLIN (72, **Orbito-cranial syphilis**) reports ten clinical observations, illustrating various and well-known clinical types of ocular disturbances produced by gummatous processes

in the orbit, or in the periosteum adjoining the optic foramen, the orbital fissures, or in the meninges in their immediate vicinity. He classifies the symptoms according to the location of the pathological process under the following headings: (a) visual; (b) pupillary; (c) ophthalmoscopic; (d) motor; (e) sensitive; (f) vascular; (g) trophic; (h) change in position of eyeball; (i) inflammatory. Some of his cases were negative as to the history and serology and clinical examination but responded promptly to the antisyphilitic treatment. He insists upon a careful examination of the visual motor apparatus in all the cases with periorbital neuralgia, because some of them may have a periostitis in the superior orbital fissure causing pressure upon the first branch of the fifth nerve. In such cases, the presence of diplopia localizes the process.

SCHOENBERG.

DIMITRY (73, **Modification of Mules's operation**) advocates the following substitute for enucleation. He separates and dissects back the circumcorneal conjunctiva and them removes the anterior segment of the globe, cutting through the sclera about *2mm* back of the cornea. The contents of the eyeball are then scraped out and a circular window is cut about the optic nerve through which the nerve is severed and the disk removed with the stump of the nerve. A small glass or gold globe is inserted and the sclera stitched over it.

ALLING.

VAN DUYSE and AUBINEAU (76, **Epithelioma of the orbit**) have removed from the inner angle of the orbit of a patient 58 years of age, a fibro-mixoma. One year later the tumor recurred and operation revealed the presence of a myxo-epithelial tumor. Finally after another year another recurrence of the tumor appeared which, by examination, proved to be an epithelioma.

SCHOENBERG.

STENGER (75, **Relations of eye diseases to diseases of the nose and accessory sinuses**) shows that acute and chronic forms of conjunctivitis may be caused by mechanical hindrance of nasal respiration through the disturbance induced in the ventilation of the accessory sinuses and the lymph circulation, and are often cured through intranasal treatment. He thinks that more attention should be paid to the nasal treatment in eczematous keratoconjunctivitis, for in addition to the above

we have often to deal in these cases with adenoids and a marked secretion of mucus. Abscesses of the orbit are almost always caused by diseases of the accessory sinuses, particularly of the ethmoid, either through direct contact, or through the blood, lymphatic, or connective tissue connections. The clinical signs of orbital diseases are familiar to ophthalmologists. Surgical interventions for their relief are often inefficient. First of all it must be determined whether an acute or a chronic inflammation is present, for the treatment varies accordingly. The chronic form calls for an incision to relieve the orbital condition, and a simultaneous thorough cleaning out of the accessory sinuses, because they contain the true focus of disease. In the acute form it is important to restore the physiological outflow of the accessory sinuses, which may often be attained by such a simple means as cocainization of the nasal mucous membrane, in spite of the threatening symptoms. Sometimes resection of the inferior turbinate is necessary. Disease of the ethmoid cells plays a great part in the acute form. Pain upon pressure in the supraorbital region is no proof that a frontal sinusitis is present. Diseases of the lacrimal sac are often caused by intranasal conditions or infections, and remarkably good results may be obtained in many through endonasal treatment. In long existing dislocations of the eyeball one must take into consideration a possible neoplasm from the accessory sinuses, especially a mucocele. The differential diagnosis of this condition is frequently very difficult. Retrobulbar neuritis induced by accessory sinus disease demands rhinological treatment. The writer thinks it not impossible that cataract and glaucoma may be caused by stasis in the orbit induced by accessory sinus disease, for intranasal changes are to be found very frequently in patients with cataract. This is a field which needs more investigation by ophthalmologists and rhinologists. Finally reflex neuroses are excited in the eye by lesions in the nose and accessory sinuses, and are amenable to treatment by the rhinologist.

IX.—THE CONJUNCTIVA.

77. DENIG, R. **Early surgical treatment of burns of the conjunctiva** *American Journal of Ophthalmology*, April, 1920.

78. DERBY, G. S. **The control of trachoma among the alien labor companies of the British and American expeditionary forces.** *Ibid.*, July, 1919.

79. EATON, F. B. **Field investigation of the ætiology of trachoma in eastern Kentucky.** *Ibid.*, June, 1920.

80. FRIEDENWALD, H. **Self-inflicted conjunctivitis.** *Ibid.*, December, 1920.

81. GONZALEZ, J. DE J. **Clinical notes on vernal catarrh and exuberant corneal conjunctivitis.** *Ibid.*, April, 1919.

82. HIWATARI, K. **Detaching the bulbar conjunctiva as a treatment of trachomatous pannus.** *Ibid.*, March, 1919.

83. HIWATARI, K. **Trachomatous changes of the caruncle.** *Ibid.*, April, 1919.

84. HOWLEY, B. M. **The treatment of trachoma and chronic conjunctivitis with negative pressure.** *Ibid.*, March, 1919.

85. KRUSE. **Necrotic phlyctænæ.** *Klin. Monatsbl. f. Augenheilkunde*, lxiv., p. 80.

86. MORTON, H. M. **Hypertrophic subconjunctivitis.** *American Journal of Ophthalmology*, June, 1920.

87. PATTERSON, J. A. **Tubercle of the conjunctiva.** *Ibid.*, September, 1919.

88. POSEY, W. C. **A case of pemphigus.** *Ibid.*, July, 1920.

89. SCHNAUDIGEL. **Conjunctiva neuro-allergica.** *Klin. Monatsbl. f. Augenheilkunde*, lxiv., p. 70.

90. SCULCO, N. **The new treatment of trachoma.** *Clinique Ophtalmol.*, viii., 2.

91. TICHO. **Epibulbar congenital tumors.** *Arch. f. Augenheilk.*, lxxxv., p. 226.

92. VEASEY, C. A. **Unusually large primary epithelioma of the ocular conjunctiva.** *American Journal of Ophthalmology*, February, 1920.

DERBY (78, **Control of trachoma among the alien labor companies in the expeditionary forces**) had charge of trachoma among the alien labor companies and treated the problem after the manner of the British with whom he was associated during part of his service. The men were Chinese, Indo-Chinese, North African, and mixed nationalities. In all 12,461 were examined. Thirteen per cent had conjunctivitis; 2% trachoma. They were classified as infected, doubtful, and clean. It was not thought possible to segregate the infected cases, as the British did, but they were treated regularly and all companies were subjected to frequent examinations in order that the new cases which developed might be quickly discovered. A copy of the instructions issued to the officers of the labor bureau is appended. ALLING.

EATON'S (79, **Ætiology of trachoma**) studies were conducted under the direction of the Public Health Service. His conclusions are that no new facts have substantially advanced our knowledge during the past few years. Climate, soil, dust, and individual predisposition are contributing causes only. There is no evidence that the trachoma virus has an ectogenous existence—the human conjunctiva is its sole habitat. By far the most potent cause of the disease is interhuman contagion due to insanitary habits. ALLING.

HIWATARI (82, **Detaching the bulbar conjunctiva as a treatment of trachomatous pannus**) makes an incision through the fornix from the inner to the outer canthus. Sutures are then introduced into the lower lip of the wound and the conjunctiva is detached from the globe down to the corneal edge. The incision is then sutured. He has operated upon twenty cases with excellent results. ALLING.

HIWATARI (83, **Trachomatous changes of the caruncle**) examined microscopically an enlarged caruncle taken from a trachomatous eye and found that it contained four lymph nodes lying close together. There were also Leber bodies which are always found in trachoma. He claims that his observation is the first to prove that follicular trachoma invades the caruncle. ALLING.

HOWLEY (84, **Treatment of trachoma and chronic conjunctivitis with negative pressure**) advocates negative pressure, of from three to seven pounds, applied by means of a glass tube. Scarification is often done before using the treatment. He claims that the procedure removes infective secretions and causes absorption of infiltrated tissue. He thinks that it is of service in cases which are too advanced for expression. ALLING.

SCULCO (90, **The new treatment of trachoma**) extracts the active principle from a plant (*Nepeta citriodora*), which according to him has a specific action upon the infectious agent of trachoma. To this extract he adds resins and glucosides contained in *Thymus serpillium* and *Salvia officinalis*. The powder obtained is enclosed in small vials. Each vial contains one dose. The remedy acts mainly when trachoma is well developed, with corneal complications. The initial stage is very little affected by it. The treatment consists of applying one

dose of powder on the tarsal conjunctiva. The eye is then covered with cotton and bandaged for about two hours. A burning sensation which follows the treatment subsides in about twenty minutes. The applications are made every day. On the third or fourth day the follicles have to be expressed with a Knapp roller forceps. Care must be taken to flush the conjunctival sac and the cornea with tepid water or salt solution to thoroughly remove particles of powder lodged in folds or on ulcerated surfaces, because these particles of powder may irritate the eye very intensely.

This remedy clears up only the trachomatous process and the corneal infiltrations; it has no effect upon a vernal catarrh or chronic conjunctivitis which may coexist.

SCHOENBERG.

GONZALEZ (81, **Clinical notes on vernal catarrh and exuberant corneal conjunctivitis**) has observed changes in refraction, usually myopic astigmatism, sometimes of high degree, accompanying this affection. He thinks that it is brought about by the fact that the pericorneal infiltration produces nutritive changes decreasing the resistance of the cornea to intraocular pressure and that the constant rubbing of the eyes, on account of the itching, tends to change the curve. He has found the X-ray beneficial. Exposures of eight minutes are made not oftener than once in three weeks.

ALLING.

MORTON (86, **Hypertrophic subconjunctivitis**) relates four cases which he considers rare. They are characterized by a more or less hardened mass involving the lower lid under the conjunctiva. The lesion is a chronic hyperplastic inflammation due to traumatism.

ALLING.

SCHNAUDIGEL (89, **Conjunctiva neuro-allergica**) includes under this term all forms of eye trouble known as chronic catarrh and dry catarrh, which have been called hysterical, are associated with photophobia and reduction of ability to do near work, last for years, and are not influenced by any form of treatment, although no essential lesion can be made out. He thinks that in the majority of cases these troubles are of tuberculous origin; that the toxines circulating in the blood render the sensory nerves of the eye allergic and hypersensitive.

Specific treatment frequently produces startling results, as shown by the clinical histories given. He has treated forty cases in the last ten years, of which thirty-six were cured by the injection of bacillus emulsion. The doses are small, the maximum 0.0001. He begins with an injection of 0.000001 and increases this dose at intervals of four or five days until the maximum is reached after three or four injections. The total number of injections is ten.

KRUSE (85, **Necrotic phlyctænæ**) reports a case in which a large phlyctæna broke down leaving a circular defect which reached deeply into the sclera. The cavity filled up gradually with cicatricial tissue, and a disk-shaped scar covered with conjunctiva long remained visible at this place.

DENIG (77, **Early surgical treatment of burns**) urges immediate operation if the burn of the conjunctiva is deep. The burned area is carefully removed and the defect covered by grafts of mucous membrane taken from the mouth. He claims that contractions and encroachment on the cornea are avoided by this method.

ALLING.

FRIEDENWALD (80, **Self-inflicted conjunctivitis**) relates two cases in one of which the conjunctiva was congested and swollen while in the other there were granulations resembling trachoma. He thinks that these conditions were produced by mechanical irritation at least, after all other treatment had been tried in vain, they recovered when the eyes were protected by a shield.

ALLING.

POSEY (88, **Case of pemphigus**) reports the case of a colored woman who suffered from a chronic skin disease which took the form of small blisters in different parts of the body. The dermatologists diagnosed it as dermatitis herpetiformis or Duhring's disease which is allied to pemphigus. The palpebral conjunctiva was injected and showed a series of irregular gray areas. There was marked shrinking of the conjunctiva with the lashes turned in against the globe. The conjunctivæ are still contracting and the corneæ are becoming hazy.

ALLING.

PATTERSON (87, **Tubercle of the conjunctiva**) reports the case of a boy who showed large masses of granulation-like

tissue springing from the conjunctiva of the upper lid in which there was deep ulceration. The child has enlarged tonsils and adenoids and a swollen parotid gland. Tubercle bacilli were found in the smears. The growth disappeared under injections of tuberculin.

ALLING.

TICHO (91, **Epibulbar congenital tumors**) found an oval, pale red, vascular tumor, 8*mm* long by 4*mm* broad, lying across the upper corneoscleral margin in a woman 25 years old. One third of it lay on the sclera, two thirds on the cornea, reaching almost to the upper margin of the pupil. It had a smooth, glistening surface covered by conjunctiva, and had a cyst about 3*mm* in diameter in the scleral portion. Dermoid was excluded by the atypical situation, the smooth surface, the absence of depressions or hairs, the soft consistence, the yellowish color, and the fact that it was distinctly movable. The clinical diagnosis was that of congenital lipoma of the conjunctiva. The histological examination after removal showed it to be composed of a superficial horny, laminated epithelium, connective tissue, fat, many vessels, and a cyst lined with cylindrical epithelium; a congenital fibrolipoma of the conjunctiva. Whether the cyst was congenital or not, and whether the fibrolipoma was conjunctival or subconjunctival, were not determined.

VEASEY (92, **Unusually large primary epithelioma of the ocular conjunctiva**) relates the case of a man, 56 years old, who since a boy had had a small reddish mass on the temporal side of the sclera. It began to grow about three years previous to the examination and then was the size of an English walnut protruding through the lids. The mass and the eyeball were removed. There was no evidence of penetration of the eyeball but the sclera was infiltrated.

ALLING.

X.—THE CORNEA, SCLERA, AND ANTERIOR CHAMBER.

93. ASMUS. **Zinciontophoresis in ulcus serpens.** *Zeitsch. f. Augenheilk.*, xlii., p. 216.

94. BULSON, A. E. **Five cilia in the anterior chamber.** *American Journal of Ophthalmology*, February, 1920.

95. BYERS, W. G. M. **Reticular keratitis.** *Ibid.*, October, 1920.

96. FEINGOLD, M. **Granuloma of the cornea.** *Ibid.*, July, 1919.

97. Fox, J. W. **A new operation for the relief of conical cornea.** *Ibid.*, October, 1919.

98. Friedman, E. D. **Unilateral anæsthesia of the cornea and conjunctiva.** *Journal of the A. M. A.*, June 21, 1919.

99. Green, A. S. and Green, L. D. **An operation for keratoconus with report of two cases.** *American Journal of Ophthalmology*, June, 1920.

100. Guist. **Dystrophia epithelialis corneæ.** *Ophth. Ges. in Wien*, October 27, 1919.

101. Lauber. **Demonstration of a case of corneal plastic.** *Ges. d. Aerzte in Wien*, December 12, 1919.

102. Loewenstein. **Transfer experiments with the virus of febrile herpes.** *Klin. Monatsbl. f. Augenheilkunde*, lxiv., p. 15.

103. Maghy, C. **Observations of blood staining of the cornea.** *Amer. Journal of Ophthalmology*, September, 1919.

104. Matsuoka, Y. **Nature of the so-called blood infiltration of the cornea.** *Ibid.*, August, 1920.

105. Pringle, J. A. **Gas infection of the cornea.** *British Journal of Ophthalmology*, March, 1919.

106. Sidler-Huguenin. **Traumatic herpes corneæ.** *Korrespondenzbl. f. Schweizer Aerzte*, 1919, No. 17.

107. Spicer, Holmes. **On the formation of clear spaces in corneal nebulæ.** *British Journal of Ophthalmology*, January, 1919.

Iontophoresis with zinc failed in only one out of the twenty-one cases reported by Asmus (93, **Zinciontophoresis in ulcus serpens**), and that was a very bad case in which Saemisch's operation had to be performed. In all of the others the effect was almost immediate. Optochin was subsequently used in some of the cases, but in five in which it had been used previously it failed to bring the ulcers to a stand still until the iontophoresis had been employed.

Loewenstein (102, **Transfer experiments with the virus of febrile herpes**) finds the virus in the blebs of herpes febrilis easily transferable to the corneæ of rabbits, where it excites a disease similar to the human herpetic keratitis. Various control experiments with the blebs from burns, pemphigus, pustules of eczema, and the blebs of herpes zoster, proved negative. The virus did not lose its virulence when transferred from the cornea of one rabbit to that of another. Its infectious quality was still present in very weak dilutions. It loses its activity after being heated for half an hour in a water bath at a temperature of 56 degrees, and after having been kept in an incubator for twenty-four hours. It is not demonstrable in the blood of patients suffering from herpes. Its

nature was not determined, except that it probably passes through the filter. The keratitis produced by the inoculation is an infiltration of the parenchyma with polynuclear leucocytes which breaks down. In the layer directly affected are to be found cystic degeneration of the epithelium, formation of blebs, breaking down of Bowman's membrane, and a mortification of the superficial layers of the parenchyma.

According to SIDLER-HUGUENIN (106, **Traumatic herpes corneæ**) herpes corneæ is in most cases due to a general febrile disease, but it is possible that it, together with fever, may occur after a traumatism. But in such cases it is not the trauma, but the fever which is the exciting factor.

All of the symptoms, the age of the patient, and the course of the disease in the case reported by GUIST (100, **Dystrophia epithelialis corneæ**) were the same as those in the cases hitherto described, with the exception that the margin between the opacity and the clear cornea was everywhere sharply defined.

FEINGOLD (96, **Granuloma of the cornea**) reports a case of burn with muriatic acid which developed a dense corneal opacity and two small tumors at the limbus. These gradually disappeared. A second case of burn with lime resulted in a granuloma of the cornea near the center and the eye was enucleated on account of glaucoma and pain. The mass showed the histological characteristics of a granuloma arising from the anterior layers of the cornea. The process of formation of these tumors seems to be that the healing of the wounds involving more or less loss of tissue is accompanied by the production of granulations. It is questioned whether some cases of supposed spindle-celled sarcoma may not have been simple granulomata. In the treatment too much manipulation should be avoided and abscission may not be advisable on account of the danger of opening an avenue of infection into the eye.

ALLING.

FOX (97, **New operation for conical cornea**) bisects the cornea with a Graefe knife making an incision in a plane parallel to the horizontal plane but above it. He then cuts a narrow strip from one edge of the wound and sutures with fine silk. He claims that little reaction takes place and the results are gratifying. ALLING.

GREEN (99, **Operation for keratoconus**) advocates a modification of the Lagrange operation in these cases on the theory that the intraocular pressure is too high for the eye although normal in measurement. He has operated upon three eyes with some improvement in vision.

ALLING.

BYERS (95, **Reticular keratitis**) reports a case of this condition which he discovered in both eyes of a man aged 47. He was able to determine that the lines were in or immediately beneath Bowman's membrane. The corneal epithelium was slightly raised as shown by distortion of the reflexes. There was no congestion of the eyes. The tension was 13*mm* and he concludes that the phenomenon is caused by buckling of Bowman's membrane and this in turn to diminished tension. Folding of Bowman's and Descemet's membranes is often observed in shrunken eyes.

ALLING.

MAGHY (103, **Blood staining of the cornea**) reports four cases showing this condition with pathological findings. One was the result of needling operations, two of perforating wounds, and one from burns from a gas attack in the war. Some dark refractile bodies staining with eosin were found and sometimes blood corpuscles. These pigment granules are transformed hemoglobin. Access to the cornea is gained through Descemet's membrane.

ALLING.

Two cases of traumatic vitreous hemorrhage throwing new light on this subject are reported by MATSUOKA (104, **Nature of the so-called blood infiltration of the cornea**). Both eyes showed spindle-shaped greenish granules in the vitreous and one of them the same bodies in the cornea. All these granules were proved by analysis to be of the same nature. He thinks that the peculiar infiltration produced from the red cells is not formed in loco but in some other place and, as such, carried to the cornea. He acknowledges, however, that there is a type of case in which the staining of the cornea is caused exclusively by freeing of the blood pigment.

ALLING.

LAUBER (101, **Demonstration of a case of corneal plastic**) showed a case in which an excellent result had been obtained

from a plastic operation on the cornea. The patient was 29 years old. The vision was $\frac{6}{12}$, and with the proper glass the patient could read fine print. The cornea had been taken from an eye that had to be enucleated on account of chronic iridocyclitis.

FRIEDMAN (98, **Unilateral anæsthesia of the cornea and conjunctiva**) has found that the corneal reflex is absent in practically all cases of hemiplegia with or without coma and attributes it to anæsthesia of the cornea and conjunctiva. The anæsthesia may be due to the presence of sensory fibers in the motor tracts but more likely to remote effect on the sensory pathways. He thinks that the phenomenon is a valuable diagnostic point.

ALLING.

PRINGLE (105, **Gas infection of the cornea**) describes cases of infection of the cornea with gas forming organisms the result of war injuries.

In one example which is illustrated bubbles of gas were seen in the layers of the true cornea. These increased in number and eventually one of them burst upon the surface. The eye was eviscerated and the man made a good recovery. The microörganisms present were: streptococci, staphylococci, bacillus perfringens, and bacillus sporogenes.

A striking feature of the cases, was the rapidity with which the cornea became infected. In each case it was only a matter of a few hours. It would appear that an actual break in the corneal epithelium is necessary before the gas organism can gain access to the substantia propria.

T. HARRISON BUTLER.

BULSON (94, **Five cilia in the anterior chamber**) reports a case in which he found five cilia in the anterior chamber following a wound of the cornea. He removed them and there was no reaction following the operation.

ALLING.

HOLMES SPICER (107, **On the formation of clear spaces in corneal nebulæ**) has made a special study of the cornea and any communication from him upon this subject is worthy of more than ordinary attention. His presidential address to the Section of Ophthalmology of the Royal Society of Medicine delivered on November 6, 1918, is a model of careful observa-

tion and clear thinking. Many ophthalmic surgeons have examined the cornea for years and yet have failed to see what Spicer presents in twenty-two illuminating pencil drawings. A careful study of the Plate which accompanies the paper fills the mind with good resolutions to use the loupe with greater persistency and see the structures which Spicer describes. Good illumination and a good platyscopic lens were employed to examine the cornea. Probably a corneal microscope would be even better, but unfortunately few ophthalmic hospitals possess them and still fewer surgeons.

Spicer points out that the changes in the cornea that follow inflammation are often striking in appearance and interest. The presence of clear lines in old corneal scars has been described by very few observers although they have long been known and were seen even before the loupe came into general use. In 1893 in the *Beiträge zur Augenheilkunde*, Fuchs published a paper upon the subject, but the best and most recent account of these lines is by that excellent observer Sydney Stephenson (*Trans. Oph. Soc. U. K.*, vols. xxxiii. and xxxv.). Stephenson ascribes the lines to the resorption of blood vessels. As the changes are dependent upon the presence of blood vessels it is necessary to recapitulate the various types of blood vessels which are seen in the cornea. These vary mostly according to their depth in the corneal tissue. Surface vessels pass over the limbus from the conjunctiva and lie between the epithelium and Bowman's membrane. They divide and twist freely like the branches of an oak tree. The *arborescent form.* These occur in superficial keratitis, ulcers, or trachoma, and represent free branching uncontrolled by the pressure of surrounding tissues. In addition to this surface invasion by trunk vessels with their branches the terminal capillary loops of the limbus advance over the cornea in a series of arches. This *terminal loop* form is common in marginal inflammation, ulcers, and trachoma. It is also seen in acute interstitial keratitis in which vessels invade the cornea at almost all depths. The terminal loops persist on fine silky lines on the surface. The *brush* or *bosom* form of vessels arise from a trunk vessel running upon the surface of the sclerotic a few millimeters distant from the limbus, it dips into the sclerotic and reappears in the cornea. The branches resemble that

of the birch rather than the oak. It is typically seen in interstitial keratitis. The *umbel form* occurs in localized inflammation of the deeper corneal layers. A single vessel invades the cornea and remains unbranched till its terminus where it divides into radial vessels like the head of a parsley flower. Generally in the cornea veins cannot be distinguished from arteries by the naked eye, but with the *loupe* each vein can be seen to be single and accompanied by one or two small arteries. The veins are larger and join without the intervention of capillaries, all these small vessels may be regarded as capillaries in which the distinction of artery and vein is retained till the final transition. It is uncommon for vessels to disappear and leave no trace, they generally remain as fine silky threads on the surface or deeper clear lines.

Vessels keep to their own level in the cornea, and do not generally anastomose with those of another layer. In severe cases of interstitial keratitis the corneal lamellæ are softened and anastomosis may occur.

The clear lines left by vessels are of two kinds, the geometrical group and what Spicer calls the mushroom cap or coral reef formation.

The geometrical lines lie in the midst of nebulæ of varying density. The lines are straight or run in long curves. They may be parallel, diverging or converging, or radiating from a center. The lines may cross each other. They can sometimes be traced to the limbus or may be confined to the center of the cornea. Spicer has little doubt that the lines have as their basis the tracks of old vessels. The tracks become straight because of the contraction of the scar tissue.

The second group resembles a mushroom in section. They are secondary to ulcerations which have become vascularized. They are also seen after attacks of scleritis in which the cornea has not taken part.

T. HARRISON BUTLER.

(*To be continued*)